Ministry for Primary Industries
Manatū Ahu Matua

Wood Availability Forecasts – New Zealand 2014–2050

Prepared for the Ministry for Primary Industries
by Indufor Asia Pacific Limited.

ISBN No: 978-1-77665-384-3 (online)

September 2016

New Zealand Government

Growing and Protecting New Zealand


Indufor

Ministry for Primary Industries Wood Availability Forecasts

A new series of Wood Availability Forecasts has been prepared by Indufor Asia Pacific for the Ministry for Primary Industries (MPI), covering the period from 2014 to 2050. These forecasts are intended as a planning tool for the forest industry, councils, and infrastructure and service providers. New forecasts for nine regional wood supply regions and for New Zealand have been published and are available on the MPI website at:

http://www.mpi.govt.nz/news-and-resources/open-data-and-forecasting/forestry/

MPI worked in association with the National Exotic Forest Description (NEFD) Steering Committee to prepare the new regional and national wood availability forecasts. NEFD user surveys have emphasised that wood availability forecasts are the most used and valued product delivered under the NEFD programme.

MPI wishes to express its appreciation to forest owners, managers and consultants for their support in preparing these wood availability forecasts. The work would not be possible without this assistance.

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PREFACE

This report was prepared at the request of the Ministry for Primary Industries (the Client) by Indufor Asia Pacific Limited.

The project involved development of a series of regional and national wood availability forecasts for New Zealand's plantation estate.

This report may only be used for the purpose for which it was prepared and its use is restricted to consideration of its entire contents. The conclusions presented are subject to the assumptions and limiting conditions noted within.

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1. INTRODUCTION

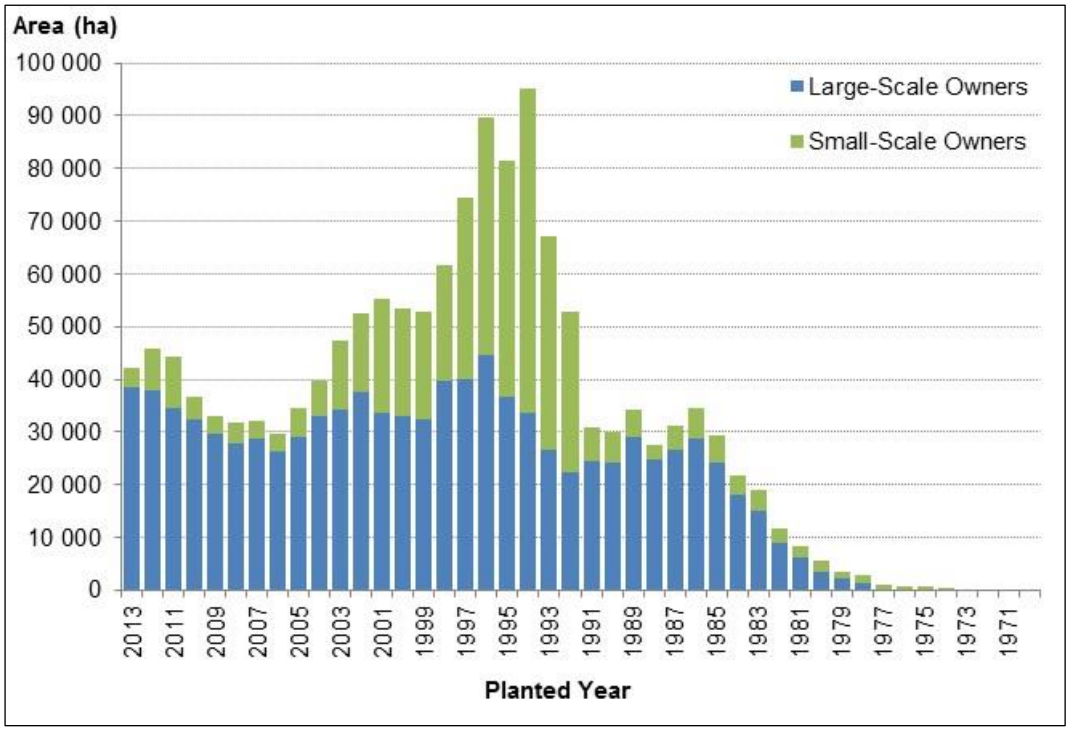
New Zealand has a planted production estate of approximately 1.72 million ha[1] as at 1 April 2015. Radiata pine makes up 90% (1.54 million ha) of this area and Douglas-fir 6% (0.10 million ha). The remainder of the area (0.07 million ha) is planted in eucalypt species, cypress species, and numerous other softwood and hardwood species.

The forecasts in this report are primarily for radiata pine and Douglas-fir which together make up 96% of the total area. Wood availability forecasts (WAF) at a regional level have been constructed for these species, and the national forecast is a summation of the individual regional forecasts. A forecast for other (minor) species has also been constructed, but at a national level only.

Figure 1-1 shows the age-class distribution of New Zealand's radiata pine resource used for modelling in the WAF. The peaks in forest area are the key driver of future increases in wood availability. The first peak reflects the mid-1990s planting boom, with between 60 000 and 95 000 ha in each age-class. These areas reach harvestable age commencing from the late 2010s/early 2020s. An uplift in planting is also apparent from 2011 – 2013, and is likely due to a combination of factors such as the replanting of the extensive mid-1980s plantings, favourable market conditions which provided more incentive to harvest and replant, and the introduction of the New Zealand Emissions Trading Scheme (NZETS) in 2008.

For further information on the forest resource description see https://mpi.govt.nz/news-and-resources/open-data-and-forecasting/forestry/#.

Figure 1-1: New Zealand Radiata Pine Area by Age-Class Distribution Used in the Modelling



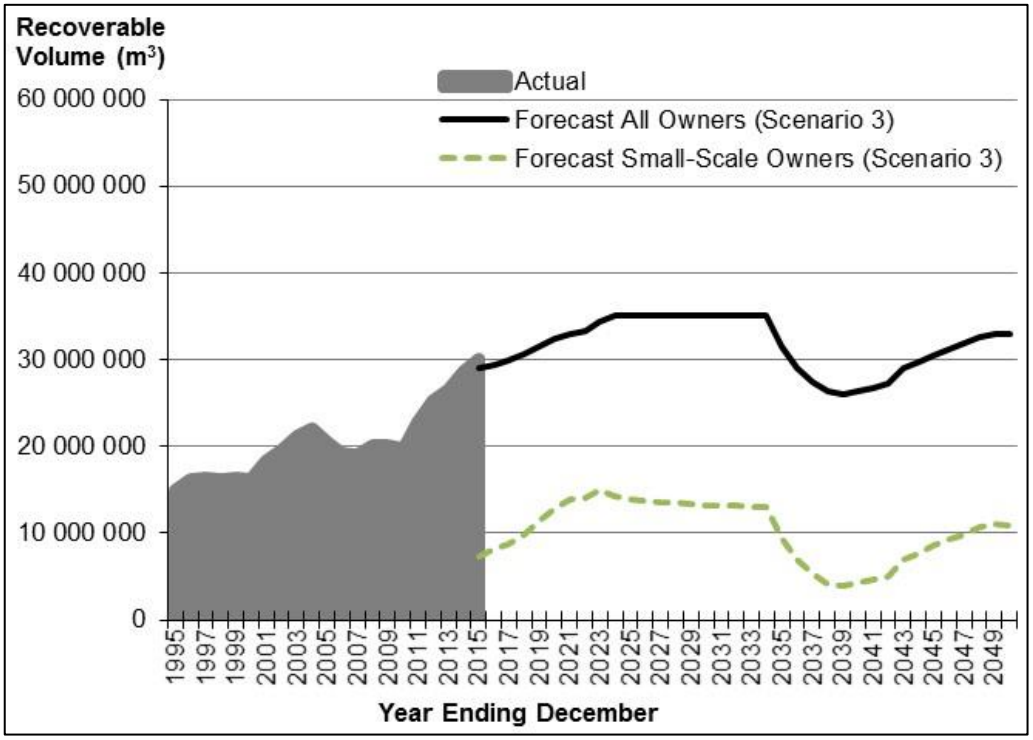
[1] Forest areas reported in this paragraph are from the National Exotic Forest Description (NEFD) as at 1 April 2015 (MPI, 2016). These areas were subsequently adjusted for modelling in the WAF (see Section 3.1).

The forecasts show a range of harvest volumes potentially available from the planted forest estate of both large and small-scale growers. The forecasts are supply-based, but do incorporate harvesting intentions of the larger-scale owners out to 2023. In utilising these forecasts, users need to recognise that market conditions will be the ultimate determinant of harvesting levels at any particular point in time.

Figure 1-2 shows historic harvest levels from 1995 to 2015 and then the forecast wood availability through to 2050 (under Scenario 3[2]). The graph shows that there was a near doubling of harvest levels between 1995 and 2015; but fluctuations have occurred year to year in response to market conditions such as log and lumber prices, shipping costs, and movements in exchange rates.

The forecasts indicate that the availability of radiata pine from the New Zealand forest estate will increase over the next 10 years, lifting to levels of up to 35 million m^3 per year from the mid-2020s. Most of this increase will come from small-scale forest growers who established forests during the 1990s. Ultimately, market conditions and logistical constraints (availability of logging crews and equipment, availability of roading contractors, engineers and planners, transport capacity, and wood processing capacity) will determine how quickly any additional wood availability can be harvested.

Figure 1-2: Historic Harvesting and Forecast Wood Availability (Actual Harvest[3] + Scenario 3 for Radiata Pine Only)



Separate forecasts have been produced for large-scale owners (owning 1 000 ha or more) and small-scale owners. For radiata pine, the large-scale owners' forests are able to supply an annual volume of around 19 to 22 million m^3 of logs. Between 2015 and 2020, the small-scale

[2] Definitions of the scenarios are provided in Section 2.1

[3] Roundwood removals are derived by MPI from log and chip export data from the ports received via Statistics New Zealand, plus regional processed product volumes converted back to a roundwood equivalent. Note that removals include Douglas-fir, eucalypts, and minor species.

owners' forests have the capacity to provide an additional 7 to 13 million m^3 per annum. From 2020, the potential wood available from the small-scale owners' forests increases to around 15 million m^3 per annum through to 2035.

There is generally more certainty around volume forecasts from the large-scale owners' forests compared with forecasts from the small-scale owners' forests. In addition, resource description information is generally less accurate for the small-scale owner resource.

Much of the small-scale owner forest available for harvest after 2015 is contained in small blocks which are geographically dispersed. These blocks are likely to be more expensive to harvest than the existing large contiguous forests that have both scale and existing roading and other infrastructure already in place. Forests that realise lower delivered log costs are likely to be harvested in preference to forests which are more expensive to harvest.

Some forests may not be harvested. For instance, forests on steep terrain, distant from processing plants/ports, small in size or without existing roads may be uneconomic to harvest if logging and transport costs are higher than the market value of the forests' recoverable log volume. A further unknown is the extent to which the NZETS could impact future harvesting decisions. The New Zealand Government has banned importing foreign credits for NZETS compliance purposes as of 1 June 2015. In addition, all sectors will move to a full obligation to surrender NZUs, which in effect will remove the one NZU for two tonnes of emissions (one-for-two) surrender obligation. As a result, the NZU spot price increased substantially from around NZ$6/NZU in January 2015 to NZ$18/NZU in July 2016[4]. Forest owners who enter their forests into the ETS may decide to lengthen the age that they harvest their forests; or with sufficiently high prices for emissions units could decide not to harvest.

Some owners will be motivated to harvest early while others may decide to grow their forests on longer. It is therefore likely that the harvesting of post-1989 forests will be spread out over a longer period than would be the case if the forests were harvested at a fixed rotation age.

In the latter part of the forecast period (post-2034) the total harvest is projected to decline under Scenario 3. This is in line with the age structure of the resource. The timing (and level) of decrease will depend on the rate at which post-1989 forests are harvested. It will also depend on whether substantial new planting resumes, and whether all harvested areas are re-established. The scenarios reported here do not include any new land planting, but assume in most cases that all harvested areas are replanted[5].

The previous series of WAFs were undertaken between 2006 and 2009 (termed the '2008 forecasts' in this report). Some of the assumptions and scenarios that were applied in those forecasts have been modified in the latest forecasts (the '2014 forecasts'). A comparison between the two forecast series is provided later in this report (Section 5).

Readers who intend using the WAFs for planning or investment decisions are urged to thoroughly review the forecast, or to engage the services of a professional forestry consultant who is able to interpret the forecasts in the context of specific planning or investment decisions.

[4] Source: Agrifax www.agrihq.co.nz

[5] Replanting assumptions are described in Section 3.4

2. SCENARIOS

These forecasts show a range of harvest volumes potentially available from the planted production forests for the period 2015 – 2050. Individual forecasts have already been published for 12 wood supply regions and sub-regions across New Zealand. There has been one change to the regional boundaries for the forecasts: in the 2008 forecasts, Auckland was defined as a separate wood supply region. However, this region has since been merged with the Central North Island and Northland wood supply regions. This change is reflected in the 2014 forecasts.

The WAFs are based on each region's forest resource and the forecasting assumptions described later in this report. The forecasts have been developed to incorporate the harvesting intentions of the large-scale[6] forest owners in each region.

The forecasts incorporate the views of each region's forest managers and consultants. This feedback was critical for ensuring that the forecasts represent a realistic range of future wood availability scenarios. The national forecasts in this report have been produced by summing the 12 regional and sub-regional forecasts.

Seven scenarios have been modelled to indicate the potential range of future wood availability, including four scenarios for radiata pine, one scenario for Douglas-fir, and two scenarios for minor species.

A key issue is the timing of harvesting by the small-scale forest owners. The age-class distribution of the small-scale owners' estate is very irregular with over 30 000 ha in each of the age-classes between 1992 and 1997, and less area in other age-classes. The challenge is how to forecast the wood availability from the small-scale owners' estate. In particular, will these areas (planted in 1992 to 1997) be harvested:

- At a fixed rotation age (Scenario 1)
- Spread over many years (Scenario 2)
- Spread over an intermediate number of years (Scenario 3)

The timing will be driven by a range of factors including individual forecast owners' objectives, forest age, log prices, demand by local wood processing plants, and perceptions about future log prices and future wood supply.

The scenarios indicate that there are many different ways the forest estate in New Zealand could be harvested. It needs to be recognised that forests are managed to maximize the benefits to the enterprise that owns them. Each enterprise has its own harvest strategy based on the owners' objectives, market conditions and the forest estate that it owns or manages. Any change in harvesting strategies by forest owners will affect the age-structure and maturity of the forests it owns. This in turn feeds back directly into future wood availability.

To ensure the scenarios used in this analysis are appropriate, they were developed in consultation with the National Exotic Forest Description (NEFD) Steering Committee. Feedback was also received from major forest owners and consultants in each wood supply region.

Different levels of uncertainty are associated with the wood availability from each component of the estate. The volumes forecast from the large-scale owners' forests – although subject to change because of changes in markets, costs, harvest intentions or changes in the resource description have greater certainty than those forecast from the small-scale owners' estate. Not only are harvest intentions less clear for small-scale owners, the resource description is generally likely to be less accurate also. "Resource description" refers to the planted area

[6] For the purposes of these forecasts, large-scale owners are generally those with 1 000 ha of forest or more in a region. Exceptions are the forests managed by investment syndicates such as Forest Enterprises Ltd and Roger Dickie NZ Ltd. While large in terms of planted area, these forests tend to have a narrow band of age-classes, and a multiple ownership structure. Combined, these factors make it likely that these forests will be managed in a manner more similar to the small-scale rather than large-scale owners.

estimates, and the yield expectations from those areas. It is often unclear with the small-scale owners whether planted or gross area has been provided in the NEFD, and for this reason an area adjustment is applied (see Section 3.1). Small-scale owners are also less likely to undertake formal inventory and develop yield tables for their forests. For these reasons the yield expectations are based on the large-scale owner yield tables (see Section 3.3).

2.1 Scenarios for Radiata Pine

2.1.1 Scenario 1: Large-Scale Owners Harvested at Stated Harvest Intentions, Small-Scale Owners Harvest Forest at Age 28

Large-scale owners' wood availability is assumed to be at stated harvest intentions until 2023. After 2023, the large-scale owners' wood availability is not allowed to decrease in the model.

Small-scale owners are assumed to harvest their forest holdings at age 28.

This is similar to Scenario 2 in the 2008 WAFs, although the rotation age for small-scale owners was 30 years in the earlier analysis.

2.1.2 Scenario 2: Non-Declining Yield (NDY) – Target Rotation 28 Years

Large-scale owners' wood availability is assumed to be at stated harvest intentions for the period 2015 to 2023. After 2023, the wood availability from large-scale owners is assumed not to decrease (as for Scenario 1). The total wood availability of radiata pine from each region is modelled to be non-declining in perpetuity with a target rotation age of 28 years. (30 years in Scenario 3 in the 2008 WAFs).

2.1.3 Scenario 3: Split Non-Declining Yield (Split NDY) – Target Rotation 28 Years

This is the same as Scenario 2 except that total wood availability of radiata pine from the region is allowed to decline after 2034 for a period of five years. Over this five-year period, an annual change of up to 10% is allowed. The yield is then required to be non-declining from 2039.

2.1.4 Scenario 4: Target Rotation Age Variations

This is similar to Scenario 3 except that target rotation ages of 26 and 30 years are also modelled (28 and 32 years in the 2008 WAFs).

Discussion of Scenarios – Radiata Pine

Figure 2-1 to Figure 2-3 illustrate the differences between Scenario 1 to 3 respectively using the combined New Zealand radiata pine resource as an example (more detailed discussion is provided in Section 4).

Figure 2-1), the forests owned by small-scale owners are assumed to be harvested at age 28. The scenario shows the "potential" availability of mature forest from small owners in any given year. This scenario directly reflects the area of forest in the small ownership category in each age-class nationally. For practical reasons, it is unlikely that the future harvesting would occur this way. The intention of this scenario is to show the potential magnitude of harvesting under favourable market conditions in any given year.

Scenario 2 and 3 (Figure 2-2 and Figure 2-3, respectively) are based on yield regulation. Yield regulation refers to where, when, and how these recoverable volumes should be extracted, and provides a more orderly harvesting volume profile that, to some degree, reflects logistical and market constraints. Under these scenarios, the future harvesting model is generally constrained to be non-declining: that is, each year the volume must be either the same or higher than in the previous year.

Illustration of Wood Availability Scenarios (National Forecasts)

Figure 2-1: Scenario 1: Large-scale Owners Harvest at Stated Intentions, Small-Scale Owners Harvest at Age 28

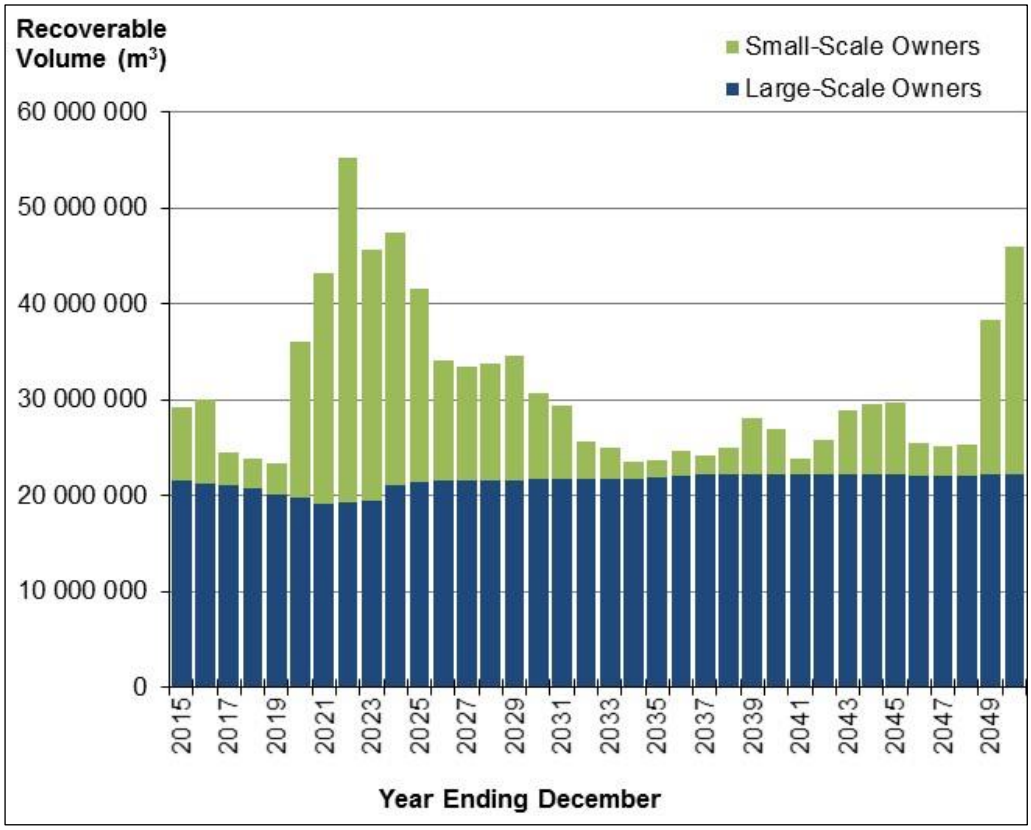


Figure 2-2: Scenario 2: Large-Scale Owners Harvest at Stated Intentions. Overall Non-Declining Yield with a Target Rotation of 28 Years

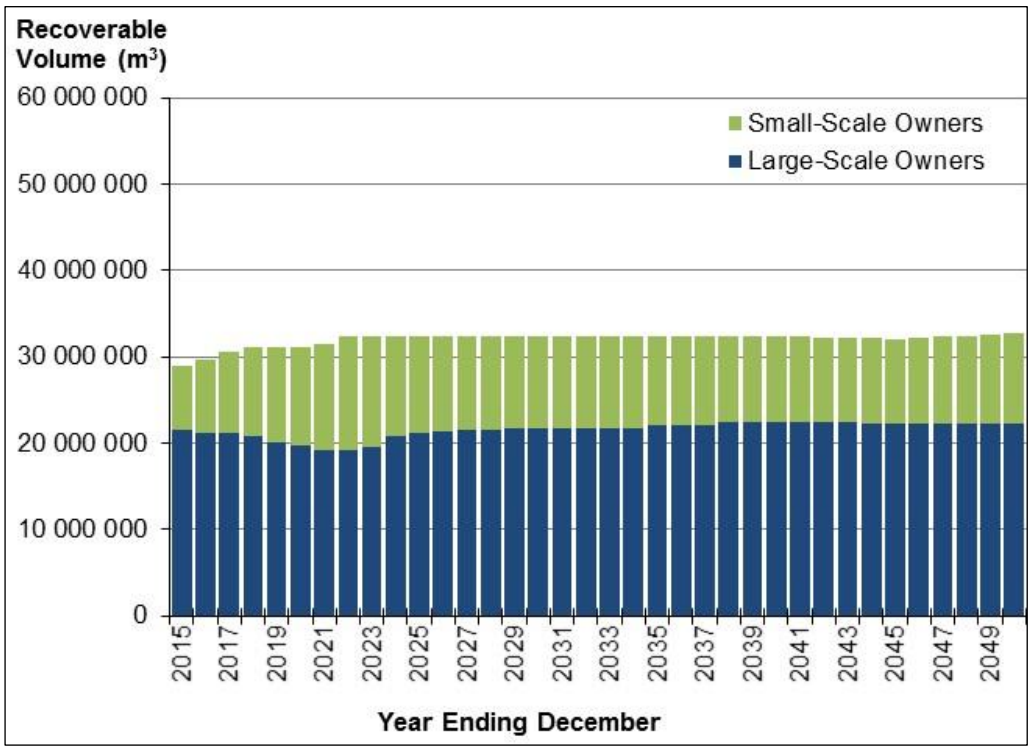
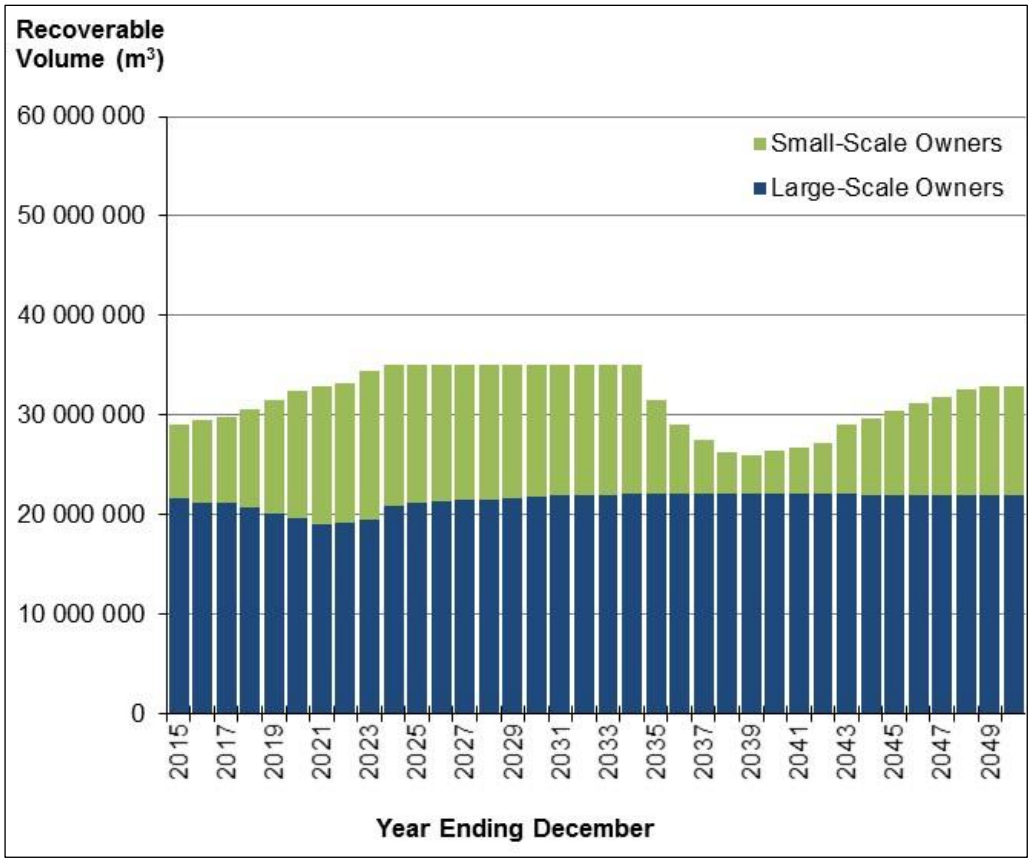


Figure 2-3: Scenario 3: Large-Scale Owners Harvest at Stated Intentions. Overall Split Non-Declining Yield with Target Rotation of 28 Years



2.2 Scenario 5: Douglas-fir

Scenario 5 is based on the harvest intentions of large-scale owners for the period 2015 to 2023 for Douglas-fir. After 2023, the wood availability from large-scale owners is modelled in five-year period non-declining yield (NDY) blocks (i.e. NDY from 2024 to 2028, NDY from 2029 to 2033, etc.). The total wood availability of the combined estate (i.e. large and small-scale owners) is also modelled to be non-declining within each of the five year blocks. The target rotation age is 40 years for Douglas-fir (45 years was used in the 2008 forecasts).

Due to highly irregular age-class distributions in East Coast and Hawkes Bay, it was not possible to obtain a non-declining yield. The constraint was therefore partially relaxed in these regions.

2.3 Scenario 6 & 7: Minor Species

The four minor species groups reported in the NEFD are cypress, other softwoods, Eucalypts, and other hardwoods.

Two scenarios have been modelled for each of these species groups: Scenario 6 which is very similar to Scenario 1 for radiata pine (large-scale owner harvest at stated intentions, and small-scale owner resource at target rotation ages as per Section 3.4.2), and Scenario 7 which is the equivalent of Scenario 2 for radiata pine (large-scale owner harvest at stated intentions, overall harvest constrained to be non-declining).

Note that minor species were modelled (and constraints applied) at the national level rather than the regional level.

3. DATA AND METHODOLOGY

3.1 Method Used to Obtain Forest Areas

Forest area was obtained from the latest NEFD data available at the time the forecasts were being developed for each region (Table 3-1).

Table 3-1: List of Wood Supply Regions and Forecast Details

Wood Supply Region	Forecast Period	Area Based on NEFD as at 1 April
Northland	2014 - 2050	2014
Central North Island	2014 - 2050	2014
East Coast	2013 - 2050	2013
Hawkes Bay	2013 - 2050	2013
Eastern Southern North Island	2014 - 2050	2014
Western Southern North Island	2014 - 2050	2014
Nelson	2014 - 2050	2014
Marlborough	2014 - 2050	2014
West Coast	2014 - 2050	2014
Canterbury	2015 - 2050	2015
Otago	2013 - 2050	2013
Southland	2013 - 2050	2013

A series of adjustments were then applied to the NEFD areas to derive the modelled areas. These are described as follows:

Small-Scale Owner Area Reduction

Areas in the small-scale owner resource were reduced by 15%. The adjustment was applied because the area in this ownership category is often reported on the basis of gross rather than net stocked area (i.e. it may include unplanted areas, areas that were not successfully established, streams, roads, or wetlands). Large-scale owner areas were not reduced as there is a high degree of confidence that their reported areas are on a net stocked basis in the NEFD.

One exception to this rule was the Canterbury small-scale owner resource. Here, a remapping exercise was undertaken by the University of Canterbury in 2014. This resulted in the modelled small-scale owner resource being 45% less than that shown in the NEFD. Further adjustments were not required.

Small Forest Grower Survey Reduction

The NEFD areas are primarily obtained from surveys of forest owners. In addition, results from the Small Forest Grower Survey undertaken in 2004 by Agriquality (now AsureQuality) are used in the NEFD dataset[7]. In the 2008 WAFs, all the planted areas defined in the Small Forest Grower Survey were included. In the latest forecasts, the planted areas of radiata pine and Douglas-fir aged 20 and over in the Survey have been excluded (in some regions). This is due to uncertainties over the reliability of this data. The total area deducted was 26 283 ha. Details by region are shown in Appendix 1.

[7] AgriQuality New Zealand (2005) Small Forest Grower Survey Report.

Over-mature Areas

Area reductions were made to allow for 'over-mature' stands. Any area above the specified maximum age is considered unlikely to be commercially viable, and was removed from the modelled areas. Age maximums are as follows:

- Radiata pine, large-scale owners: 35 years
- Radiata pine, small-scale owners: 40 years
- Douglas-fir, all owners: 60 years
- Other species, all owners: 50 years

Immature Age-Class Reductions

Area reductions of 3% to 5% (depending on region) were applied to all areas age 1 to 4 to reflect losses in stocked area due to factors such as erosion, slips, and various setbacks. These adjustments were made following discussion with regional forest owners and consultants.

Second Rotation Adjustments

Following the harvest of first rotation areas, there is typically slightly less area re-established into the subsequent crop. This reflects the establishment of new roads and landings, set-backs from streams, and inaccessible areas. The level of reduction was based on feedback from each region and was typically around 3%.

3.2 Large-Scale Owners' Harvest Intentions

Large-scale owners were asked to provide details of their projected harvest volumes (by log grade, area and average harvest age) for the 2014 to 2034 period. Inclusion of actual levels of intended harvest by the large-scale owners is considered a critical step, as it provides the best estimate of future wood availability for the first ten years of the forecast horizon. The harvest intentions data is also used to calibrate the yield tables used in the modelling process (see Section 3.3).

3.3 Method Used to Develop Yield Tables

For the 2008 WAF, new yield tables were developed for each region in the following manner:

- Large-scale forest owners provided yield tables for their forest estates.
- These tables were averaged on an area-weighted basis to derive regional yield tables for each croptype.
- The area-weighted average regional yield tables for "old" radiata pine and Douglas-fir (planted before 1990), were then calibrated to match the harvest intentions data provided by large-scale owners. The assumption is that the harvest intentions data is the most accurate information available, as it is based predominantly on detailed inventory and on other know factors that affect merchantable volume.
- The area-weighted average regional yield tables for "young" radiata pine and Douglas-fir croptypes (planted in 1990 and later) were also adjusted based on consultation with large-scale owners.
- The area-weighted average yield tables developed for the large-scale owners' estate for each region were also applied to the small-scale forest owners' estate.

For the latest forecasts the yield tables developed in 2008 were utilised, but were re-calibrated to the latest harvest intentions information provided by large-scale forest owners (the process described in the third and fourth bullet points above was repeated to derive yield tables that

reflected yields expected by the large owners). As was the case in the 2008 WAF, the calibrated large-scale owner yield tables were applied to the small-scale owner resource.

An alternate yield table calibration process was followed in the Canterbury region. This was because the large-scale owner's yield tables in this region are heavily influenced by the low productivity forests on the Canterbury plains, while most of the small-scale owners' resources are located on the higher productivity foothills. In consultation with regional forest owners and consultants, it was agreed that the small-scale owners' yield tables would be adjusted to reflect this productivity difference[8].

Minor species were not modelled in the 2008 WAF, meaning the development of new yield tables was required. Indufor combined yield information from various sources including information published by the New Zealand Farm Forestry Owners Association[9], and derived one yield table to represent cypress and other softwoods, and a second yield table to represent eucalypts and other hardwoods. These yield tables were then calibrated using the same process as described above, i.e. comparing the base yield tables to the yields implied from the harvest intentions data. The assumption is that the harvest intentions data is the most accurate information available, as it is based predominantly on detailed inventory. The area-weighted average national yield table developed for the large-scale owners' estate for each minor species group was also applied to the small-scale forest owners' estate.

3.4 Modelling Assumptions

Although the WAFs for each region are based on the same general process, there were some exceptions as a result of particular regional conditions, and advice provided by local forest managers and consultants.[10]

3.4.1 Starting Period Harvest Volumes

The overall harvest in period 1 of each regional model was constrained to match actual harvest from that region for the previous year[11]. The large-scale owner component of this harvest was assumed to match the harvest intentions, leaving the difference being the small-scale owner harvest volume.

3.4.2 Target Rotation Age

The target rotation ages are listed in Table 3-2. Note that the target age for the main radiata pine scenarios has reduced to 28 years in the latest forecasts (was 30 years in the 2008 WAF).

[8] The level of yield increase as a result of this adjustment was 18%.

[9] Source: New Zealand Farm Forestry Association
http://www.nzffa.org.nz/system/assets/2079/Cypresses_Handbook.pdf

[10] Forecasts for the West Coast were developed using a different approach. A single forecast for 2015 to 2023 was compiled by combining the harvesting intentions of large-scale owners with estimated annual volumes from small-scale owners. West Coast forecast volumes (extended to 2050) are included in all results presented in this report.

[11] Roundwood removals are derived by MPI from log and chip export data from the ports received via Statistics New Zealand, plus regional processed product volumes converted back to a roundwood equivalent

Table 3-2: Target Rotation Age by Scenario

Scenario	Target Rotation Age (Years)
1 (Radiata pine)	28
2 (Radiata pine)	28
3 (Radiata pine)	28
4A (Radiata pine)	26
4B (Radiata pine)	30
5 (Douglas-fir)	40
6-7 (Minor – Softwood)	35
6-7 (Minor – Hardwood)	15-25

3.4.3 Regeneration Species

In almost all cases radiata pine areas are maintained in this species upon replanting. The exception is Otago, where Indufor was advised that around 5 500 ha of radiata pine stands would be re-established in Douglas-fir after harvest.

The regeneration assumptions for Douglas-fir are set out in Table 3-3. Apart from Canterbury, Otago, and Southland, most or all of the Douglas-fir areas are re-established to radiata pine after harvest.

Table 3-3: Douglas-fir Replanting Assumptions

Region	All Owners	
	Douglas-fir to…	
	Douglas-fir	Radiata pine
Northland	0%	100%
Central North Island	15%	85%
East Coast	0%	100%
Hawkes Bay	0%	100%
Eastern Southern North Island	10%	90%
Western Southern North Island	10%	90%
Nelson	10%	90%
Marlborough	10%	90%
Canterbury	100%	0%
Otago[12]	100%	0%
Southland	100%	0%

3.4.4 Regeneration Regime

Areas in unpruned croptypes are replanted back into an unpruned croptype following harvest. Regeneration rules for pruned croptypes vary by region and owner size. The regeneration ratios shown in Table 3-4 reflect the consensus of forest owners, managers, and consultants from each region. The general pattern is for a migration from pruned to unpruned silvicultural management in replanted areas.

[12] This refers to around 5 500 ha of radiata pine to be replanted into Douglas-fir between 2015 and 2034.

Table 3-4: Replanting Regime Rules by Ownership Class and Region

Region	Large-Scale Owners		Small-Scale Owners	
	From Pruned to		From Pruned to	
	Pruned	Unpruned	Pruned	Unpruned
Northland	0%	100%	75%	0%
Central North Island	25%	75%	50%	50%
East Coast	100%	0%	50%	50%
Hawkes Bay	50%	50%	75%	25%
Eastern Southern North Island	90%	10%	65%	35%
Western Southern North Island	5%	95%	50%	50%
Nelson	10%	90%	50%	50%
Marlborough	10%	90%	50%	50%
Canterbury	30%	70%	5%	95%
Otago	40%	60%	70%	30%
Southland	40%	60%	70%	30%

3.4.5 New Land Planting

No new land planting has been included in the forecasts.

3.4.6 Deforestation

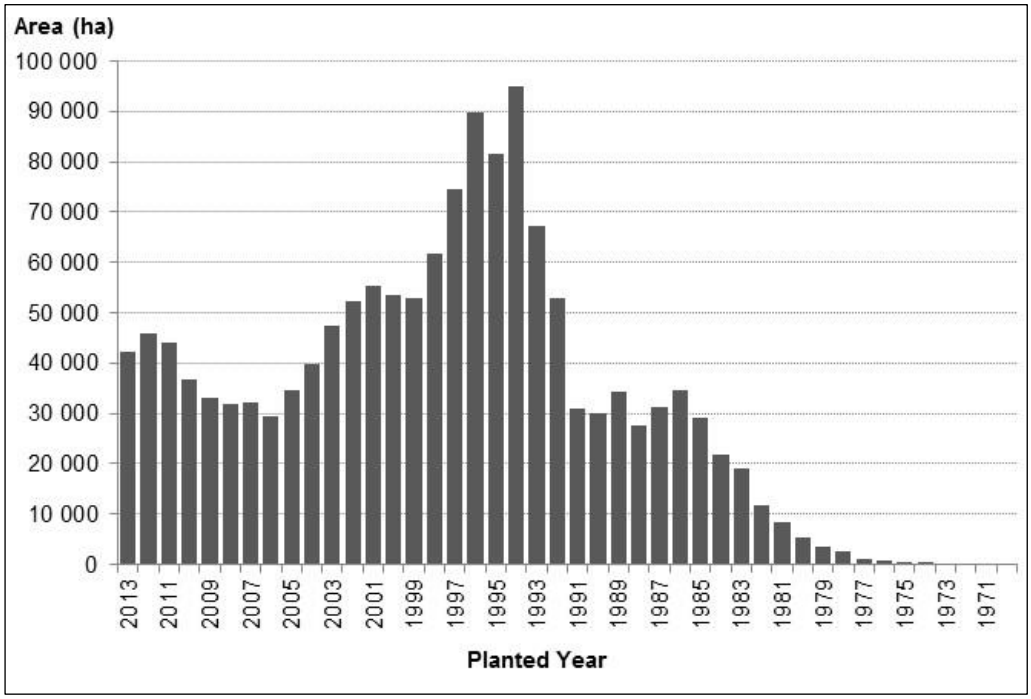
The default modelling assumption is that all areas are replanted following harvesting (with a regeneration lag of one year). However, based on discussions with forest owners and consultants, it was determined that conversion of forests to other land uses has been occurring in certain regions, and is likely to continue at a sufficient rate for it to be incorporated into the WAFs. The regions where deforestation is allowed for in the model are as follows:

- Canterbury: 5 000 ha by 2020 (ex the large-scale owner resource)
- Northland: 7 000 ha by 2024 (ex the large-scale owner resource)
- Central North Island: 26 000 ha by 2026 (ex the large-scale owner resource)

4. NEW ZEALAND NATIONAL FORECAST RESULTS

For Scenarios 1 to 4 (radiata pine), the total *modelled*[13] net stocked area of all the regional forest estate models for radiata pine was estimated to be 1.48 million ha (as at the applicable NEFD modelling date – see Table 3-1). Large-scale owners accounted for approximately 68% and small-scale owners accounted for around 32% of the total net stocked area of radiata pine. The overall age-class distribution is shown in Figure 4-1.

Figure 4-1: Age-Class Distribution of New Zealand Radiata Pine as at Modelling Date – All Owners



The age-classes of the large-scale owners (Figure 4-2) are more evenly distributed than the small-scale owners (Figure 4-3), as the mid-1990s planting boom primarily occurred in the small-scale forest resource.

[13] i.e. after adjustments to the area as described in Section 3.1

Figure 4-2: Age-Class Distribution of New Zealand Radiata Pine as at Modelling Date – Large-Scale Owners

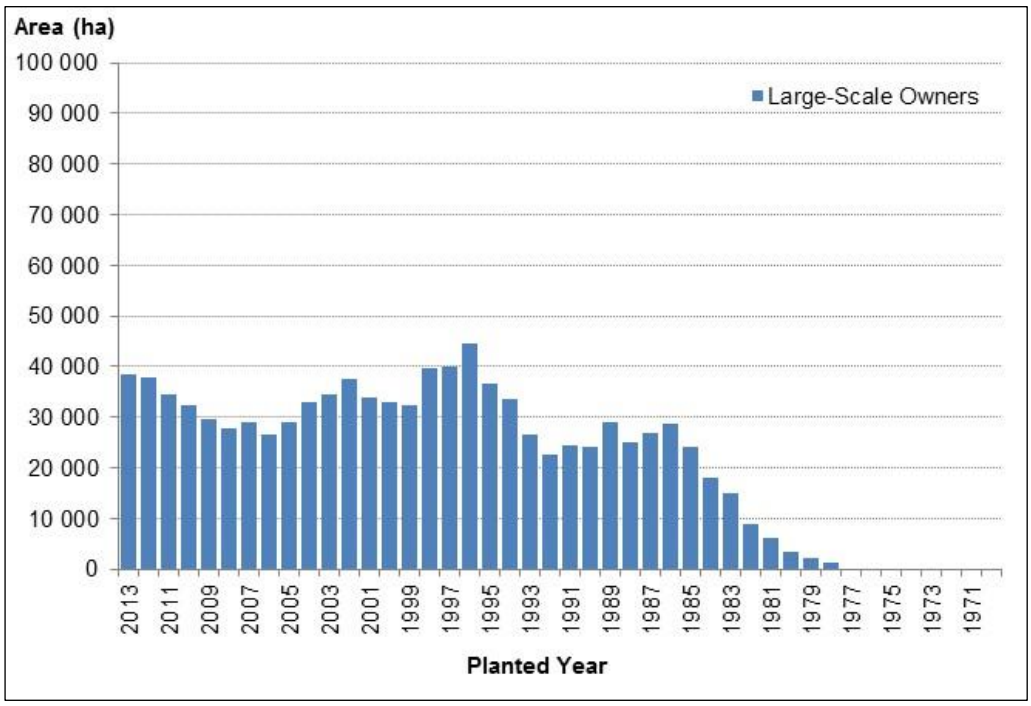
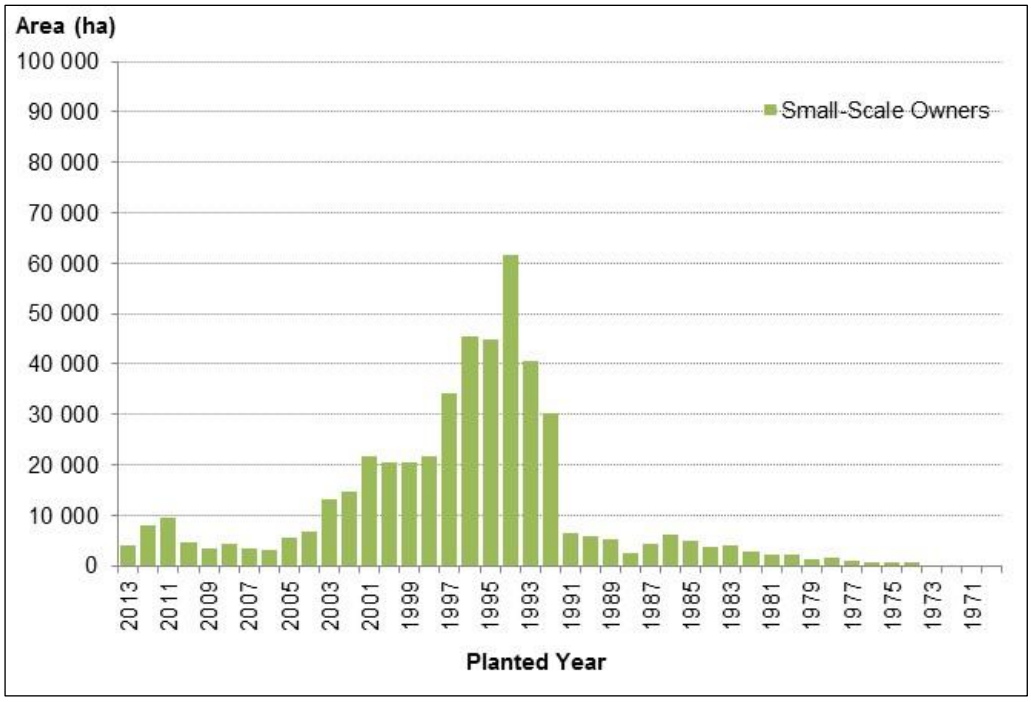


Figure 4-3: Age-Class Distribution of New Zealand Radiata Pine as at Modelling Date – Small-Scale Owners



4.1 Scenario 1: Large-Scale Owners Harvest at Intentions, Small-Scale Owners Harvest Forest at Age 28 (Radiata Pine)

In this scenario, large-scale owners harvest in line with their stated harvest intentions through to 2023. Thereafter (in most regional models) the availability is constrained to be non-declining with a target rotation age of 28 years. Small-scale owners harvest their forests at age 28.

The wood availability from all owners for Scenario 1 is presented in Figure 4-4.

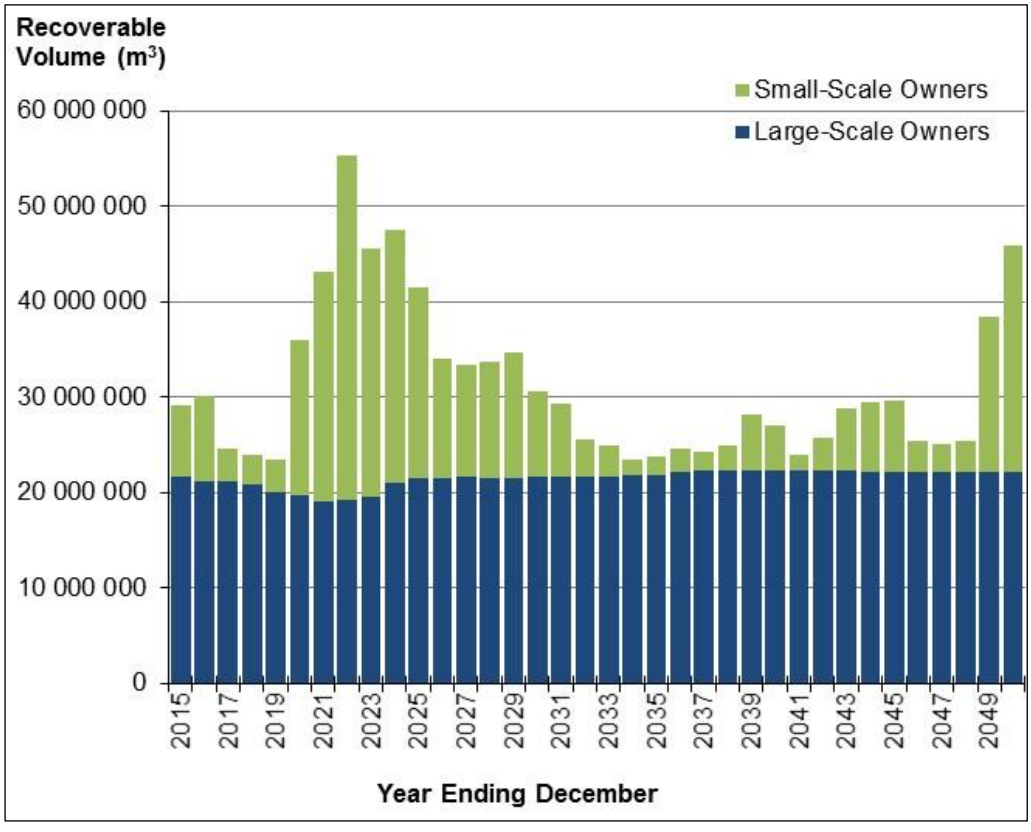
Large-Scale Owners

Based on the harvest intentions provided by the large-scale owners, the wood availability from large-scale owners is relatively steady at a national level, at 19-21 million m^3 per annum. The decline observed in the early 2020s is due mainly to reductions in Northland and Canterbury regions.

Small-Scale Owners

As all forests in the small-scale owners' estate are assumed to be harvested at age 28, the fluctuations in the total volume harvested reflect the variation in the age-class distribution of the small-scale owners' estate. Changes in annual supply levels of this magnitude are unlikely to occur because of market and logistic constraints. For instance, there would be insufficient harvesting and transport capacity to handle such large increases in volumes. Nevertheless, the scenario illustrates the theoretical supply level.

Figure 4-4: New Zealand Radiata Pine Availability Under Scenario 1 – All Owners

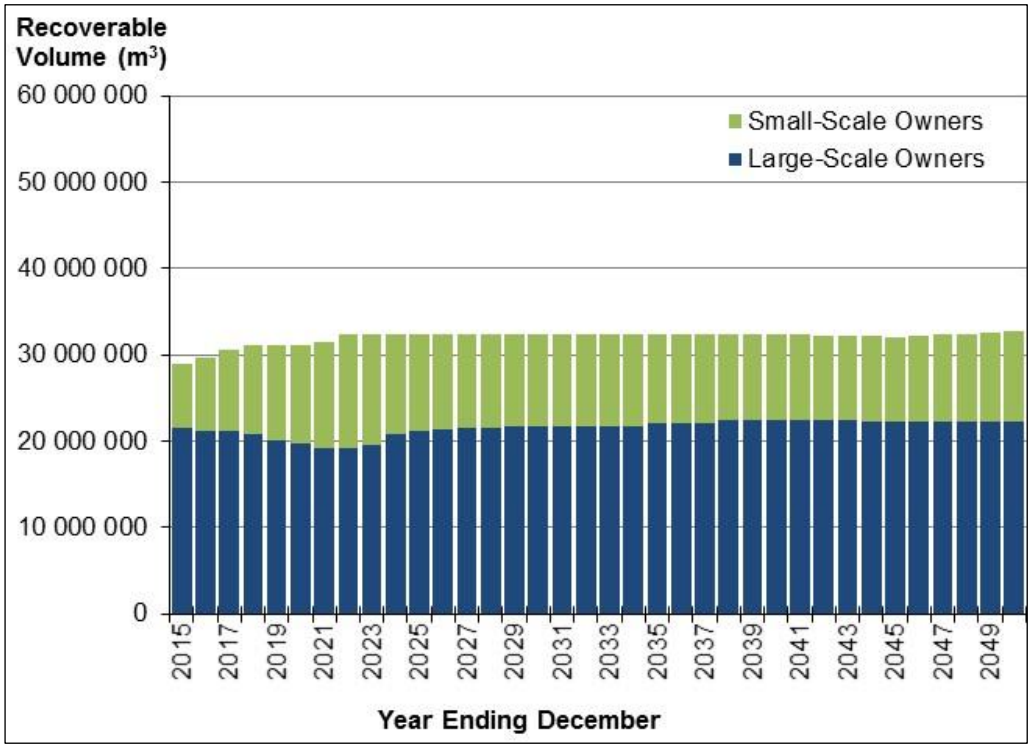


4.2 Scenario 2: Non-Declining Yield (NDY) – Target Rotation 28 Years (Radiata Pine)

Large-scale owners' wood availability is assumed to be at stated harvest intentions for the period 2015 to 2023. After 2023, the wood availability from large-scale owners is assumed not to decrease (as for Scenario 1). However, unlike Scenario 1, the total wood availability of radiata pine from each region is modelled to be non-declining in perpetuity with a target rotation age of 28 years. Figure 4-5 indicates that a long term sustainable harvest of around 32 million m^3 per annum is possible from the national radiata pine estate.

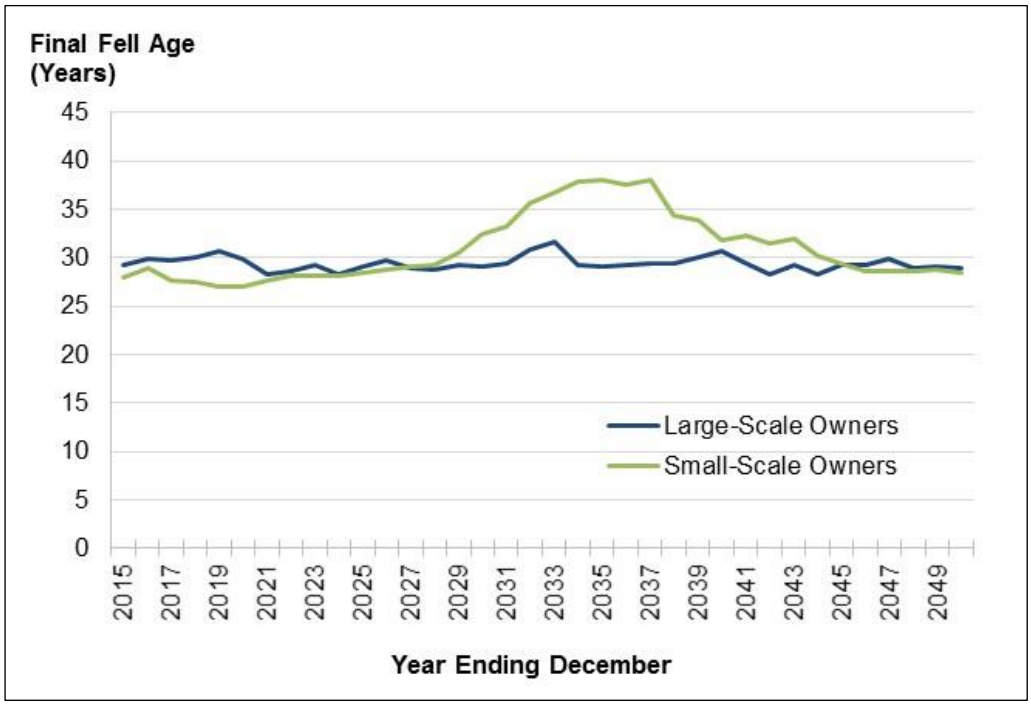
The average rotation age[14] for the large-scale owners' estate is close to the target of 28 years. However, this scenario results in the small-scale owners' estate being harvested at rotation ages significantly higher than the target of 28 years (Figure 4-6) during the 2030s.

Figure 4-5: New Zealand Radiata Pine Availability Under Scenario 2 – All Owners



[14] National average clearfell age is calculated on an area-weighted basis from the results of the regional models.

Figure 4-6: Average Radiata Pine Clearfell Age Under Scenario 2 by Ownership Category



4.3 Scenario 3: Split Non-Declining Yield (Split NDY) – Target Rotation 28 Years (Radiata Pine)

Scenario 3 is based on a split non-declining yield (split NDY), with a rotation age of 28 years. This scenario gives a WAF that is similar to Scenario 2 in the near term (Figure 4-7). Wood availability increases to just over 35 million m^3 per annum between 2024 and 2034, then gradually reduces to 26 million m^3 in 2039 before steadily rising back to another peak of 33 million m^3 in 2049.

The main difference from Scenario 2 is that there is more flexibility in the harvest constraints. The Scenario 2 harvest profile and clearfell age charts indicate that there is a 'bank' of small-scale owner volume that is being constrained in order to meet the non-declining yield constraint of Scenario 2. Scenario 3 permits some of this volume to be harvested earlier, and at an age closer to the target of 28 years. This is illustrated in Figure 4-7, which shows that the harvest volumes of small-scale owners could increase from 7 million m^3 in 2015 to over 14 million m^3 by 2023. The increase is expected to be mainly driven by harvesting from the Southern North Island, East Coast, Marlborough, and Otago/Southland regions. This in turn means that that the national harvest can increase to 35 million m^3 through to the mid-2030s. Effectively, volume is 'brought forward' (compared to Scenario 2) which of course means that the harvest level drops for a time (late 2030s/early 2040s).

Despite the more relaxed harvest constraints under Scenario 3, Figure 4-8 shows that the small-scale owner harvest age still rises to around age 35 years through the 2030s, suggesting that a higher harvest level may eventuate through the period 2020 to 2025.

Figure 4-7: New Zealand Radiata Pine Availability Under Scenario 3 – All Owners

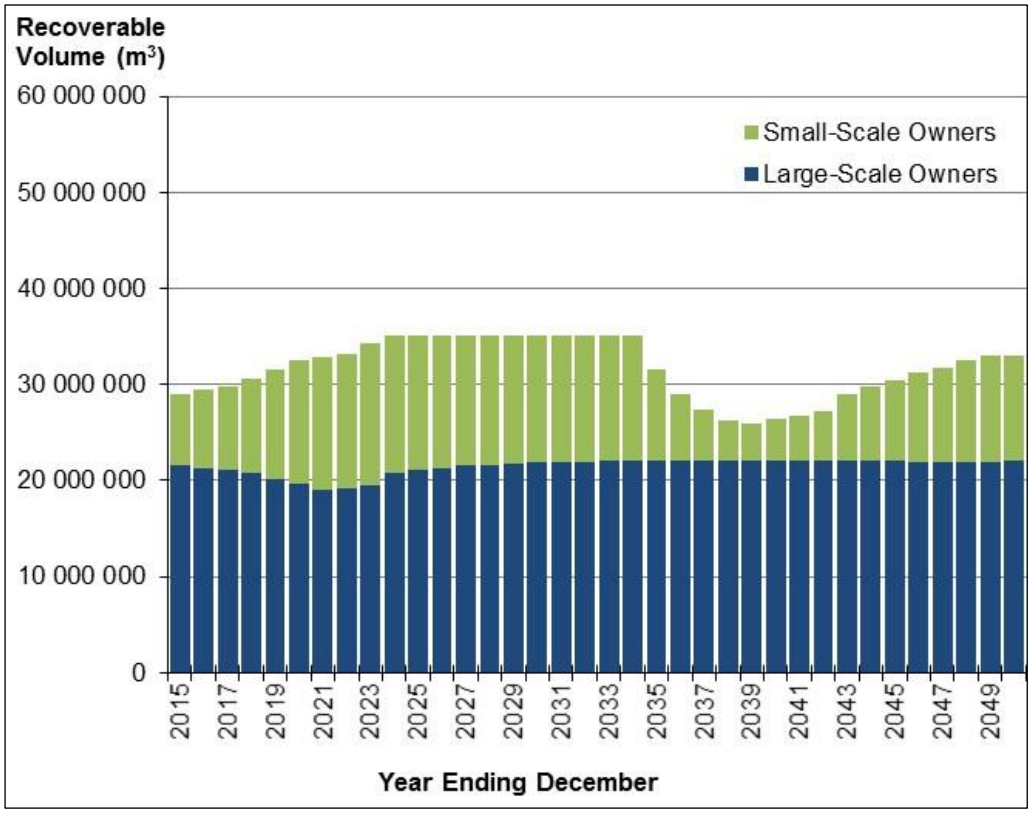
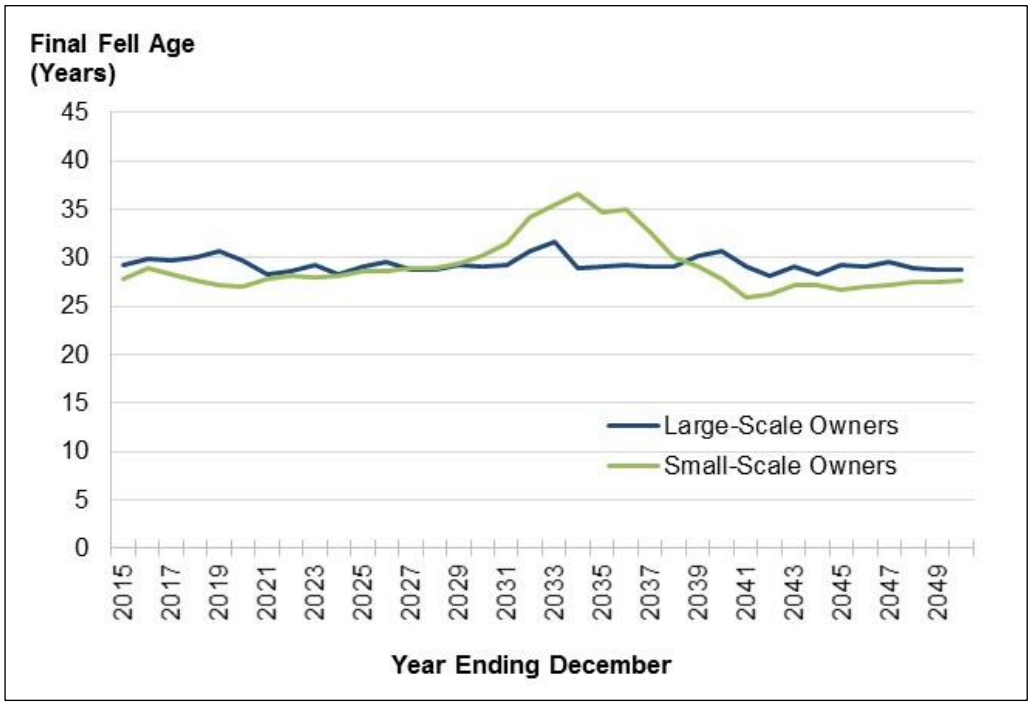


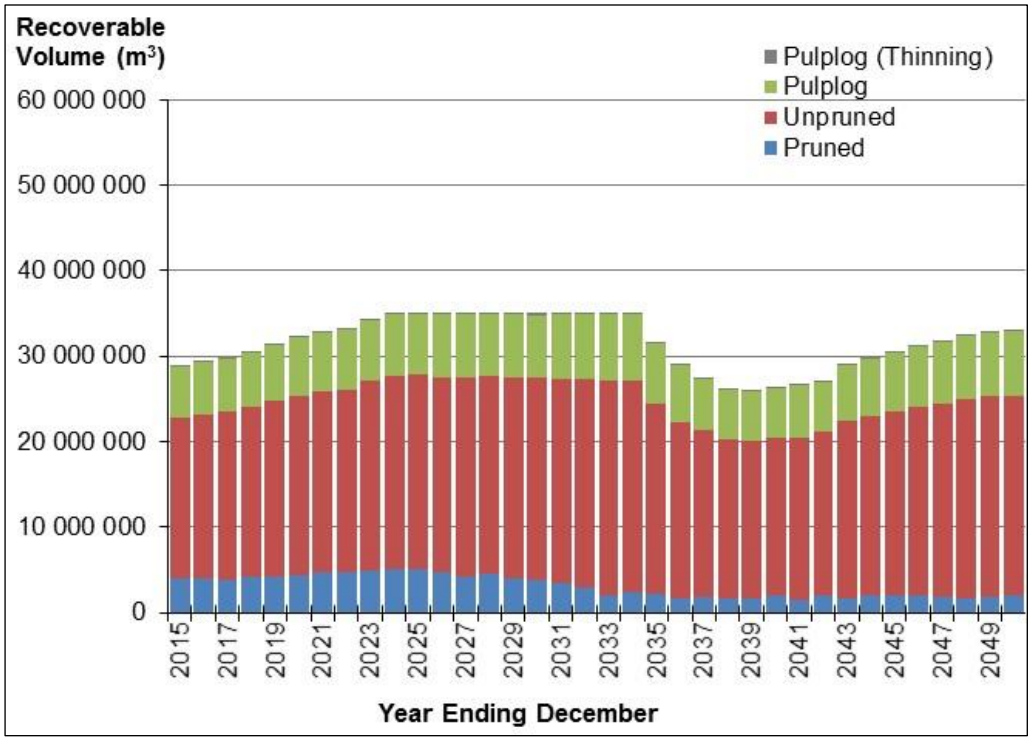
Figure 4-8: Average Radiata Pine Clearfell Age Under Scenario 3 by Ownership Category



The national wood availability of radiata pine for Scenario 3 is broken down by log grade for all owners in Figure 4-8. Of note is the declining availability of pruned logs from the mid-2020s.

This reflects the trend of a reduced intensity of pruning in most regions, as discussed in Section 3.4.4.

Figure 4-9: New Zealand Radiata Pine Availability Under Scenario 3 by Log Grade – All Owners



4.4 Scenario 4: Target Rotation Age Variations for Radiata Pine

Different wood availability profiles are generated if the target rotation age is changed from 28 years to either 26 or 30 years (Figure 4-10). Because of the limitation imposed by the current age-class distribution and large-scale owners' stated harvest intentions, it takes some time to achieve separation of average clearfell age (Figure 4-11) among the different target rotation lengths.

As shown in Figure 4-10, a lower target harvest age (26 years) allows volume to be brought forward in comparison to the base case age of 28 years; a higher target harvest age (30 years) delays the harvest.

There is a range of possibilities for the timing of the increase and the level of the potential harvest volume. These possibilities largely arise because of alternative harvest profiles for the small-scale owners' estate (Figure 4-12).

Figure 4-10: New Zealand Radiata Pine Availability Under Scenario 4 – All Owners

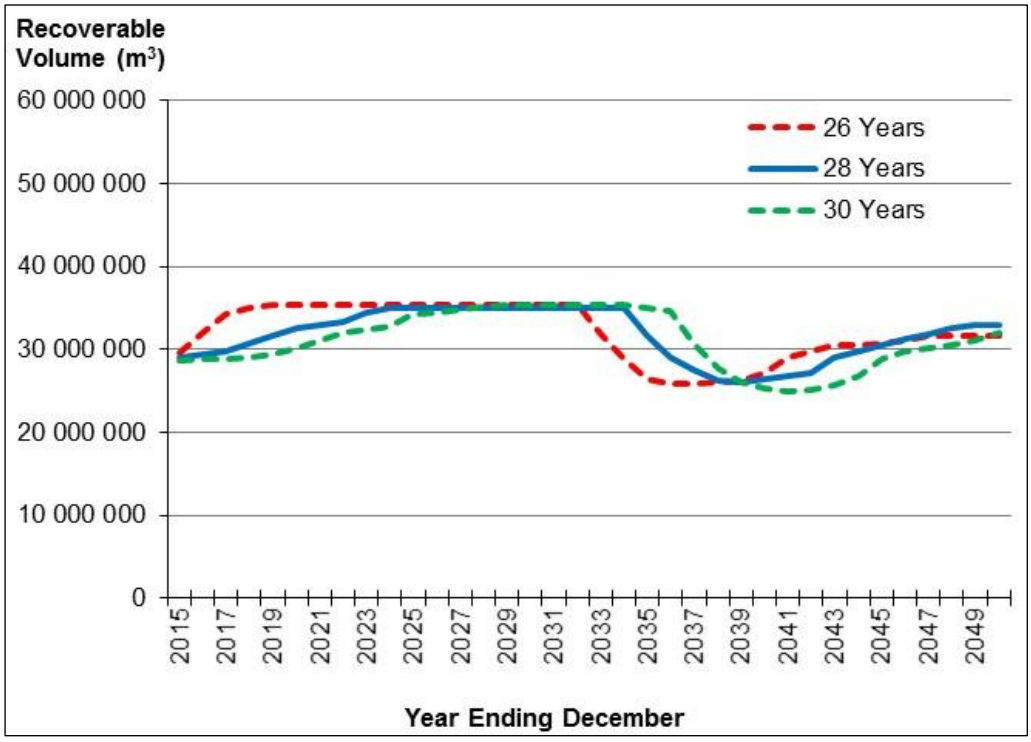


Figure 4-11: Average Radiata Pine Clearfell Age Under Scenario 4 – All Owners

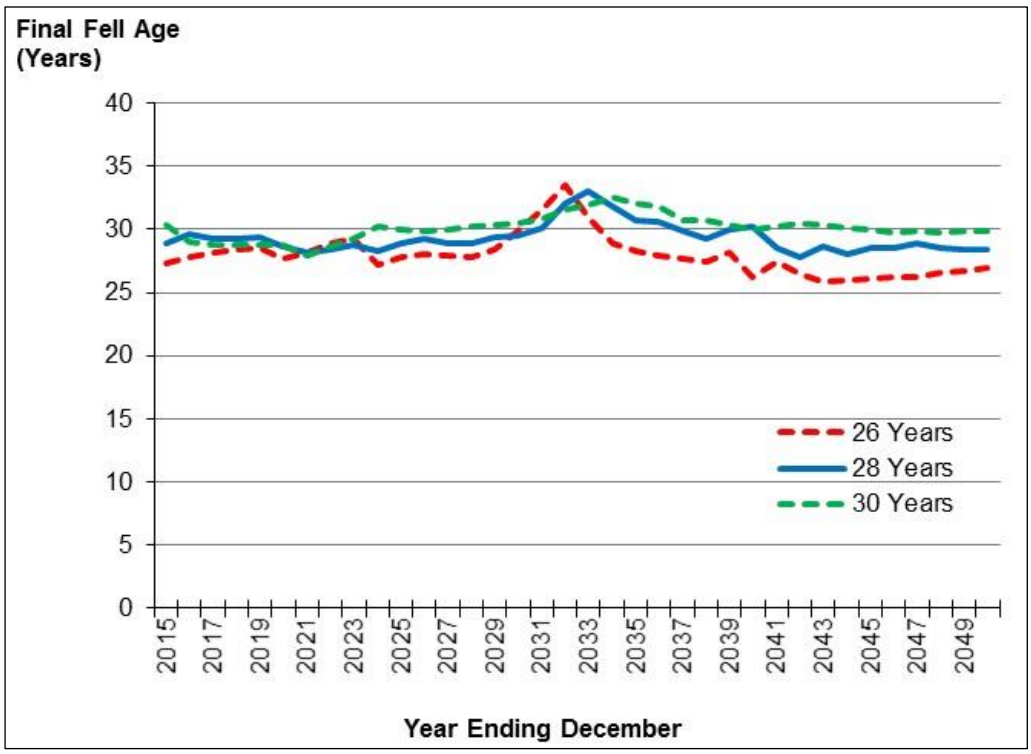
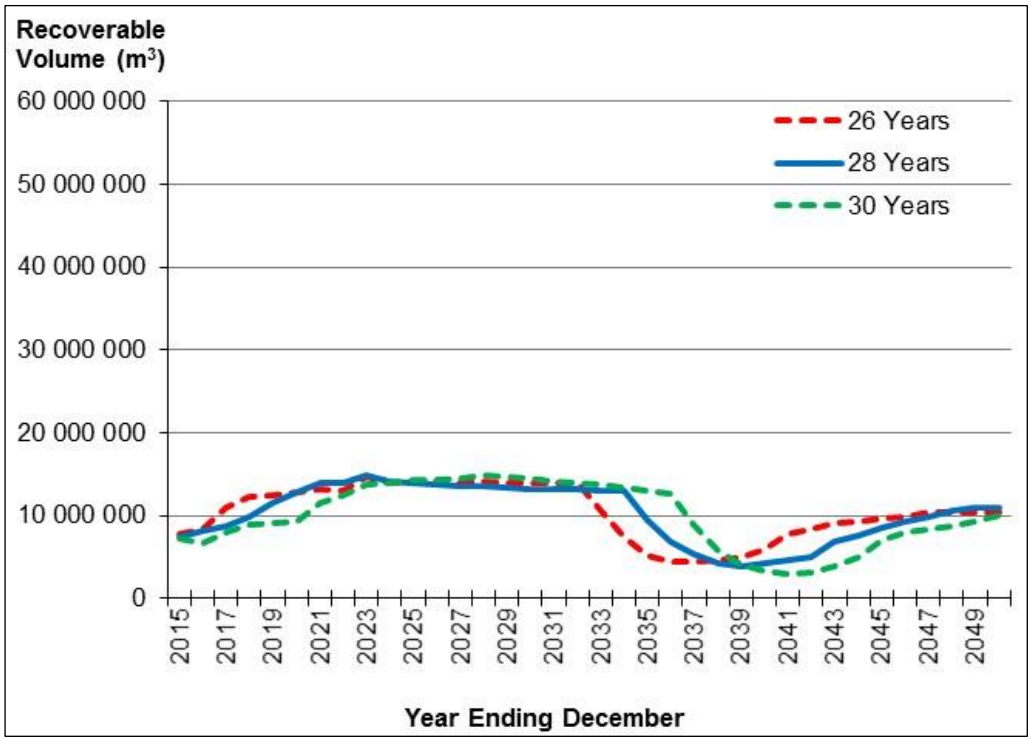


Figure 4-12: New Zealand Radiata Pine Availability Under Scenario 4 – Small-Scale Owners Only

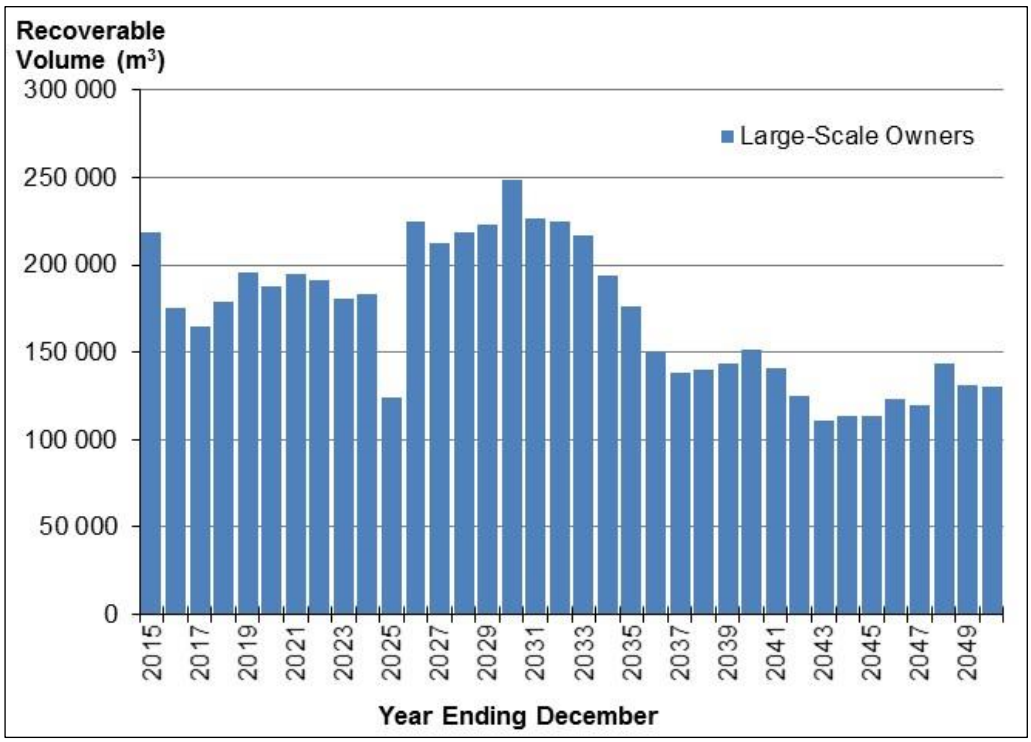


4.4.1 Production Thinning Volumes for Scenario 3 – Radiata Pine

Potential volumes from production thinning are shown in Figure 4-13 for Scenario 3 (radiata pine only). According to the large-scale owner harvest intentions, production thinning (of any significance) occurs in the Central North Island and Hawkes Bay regions only. Volumes are at a very low level compared to the clearfell volumes - production thinning is not widely practised in New Zealand plantation forestry due to the availability of suitable markets, and the generally high delivered cost of thinning logs.

Production thinning is not assumed to occur at any significant scale in the small-scale owner resource and has not been modelled.

Figure 4-13: New Zealand Radiata Pine – Volumes Available from Production Thinning Under Scenario 4



4.5 Scenario 5: Douglas-fir

The total *modelled*[15] net stocked area of all the regional forest estate models for Douglas-fir was estimated to be 97 435 ha (as at the applicable NEFD modelling date – see Table 3-1).

WAFs for Douglas-fir were developed for each region except Northland (where the species is not present). The approach to yield regulation varied by region, depending on the age-class distribution and whether there was an intention to replant harvested areas back into Douglas-fir. Figure 4-14 shows the national age-class distribution.

Figure 4-15 shows the national wood availability for Douglas-fir and Figure 4-16 shows the wood availability by log grade. The national wood availability is expected to increase gradually from 1.0 million m^3 in 2015 to 1.2 million m^3 per annum in the early 2030s, and further increase to around 1.8 million m^3 in the early 2040s. It is expected to decline from 2049 once the age-classes that were planted during the planting boom (between the mid-1990s and early 2000s) are harvested.

The increase of wood availability of Douglas-fir is expected to be driven by the plantations in the Otago and Southland regions.

[15] i.e. after adjustments to the area as described in Section 3.1

Figure 4-14: Age-Class Distribution of New Zeland Douglas-fir as at 1 April 2014

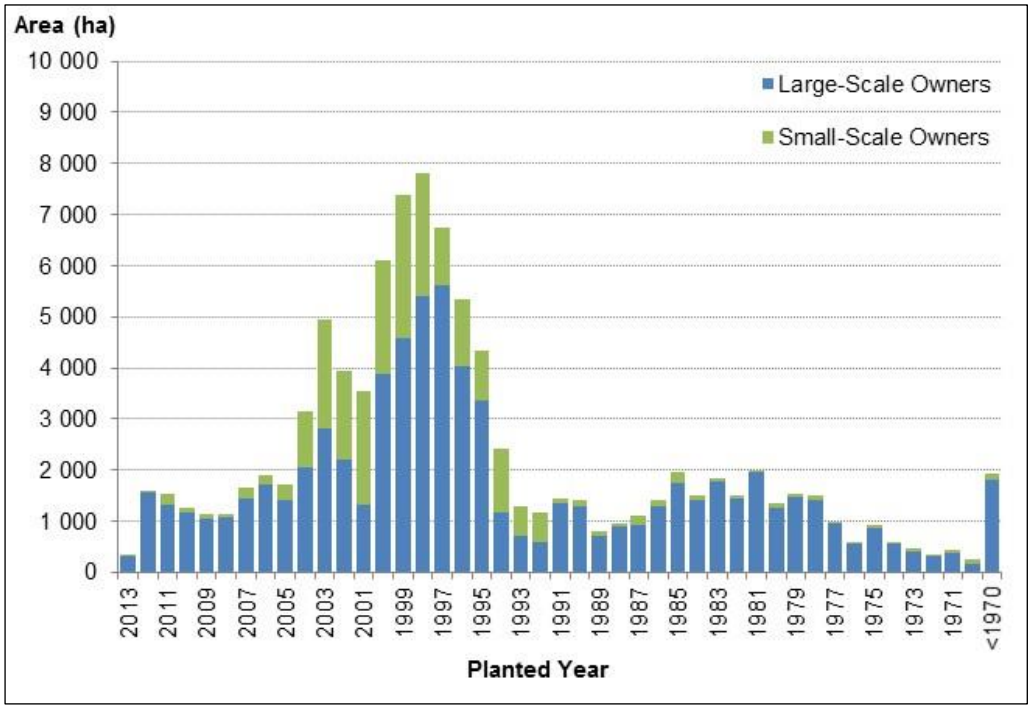


Figure 4-15: New Zealand Douglas-fir Wood Availability

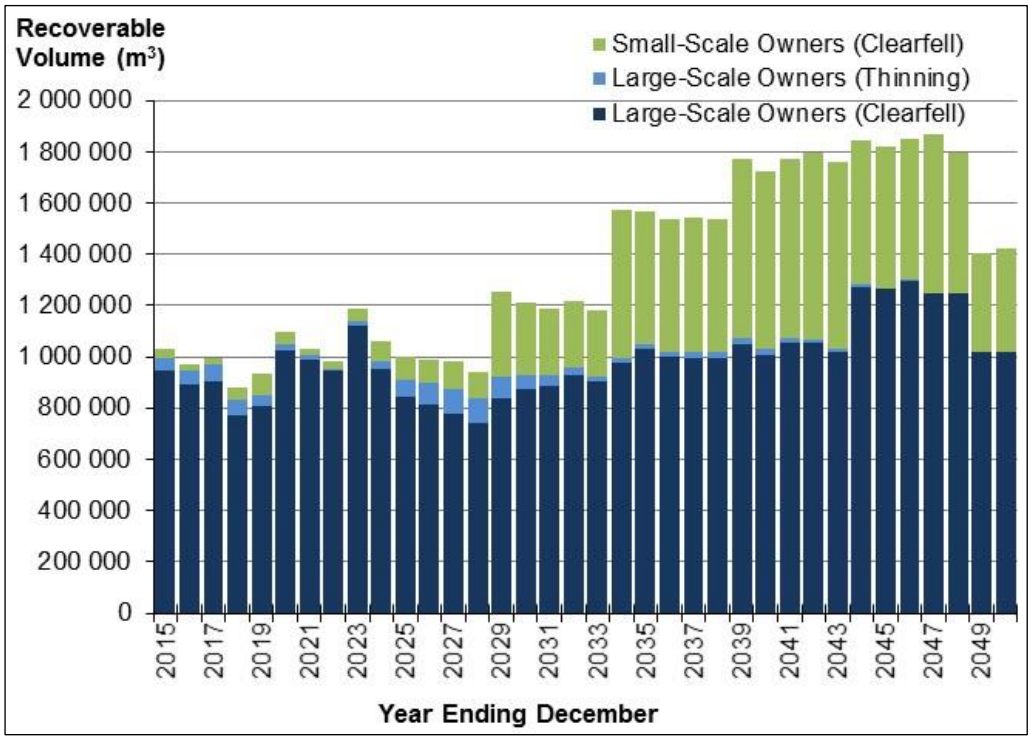
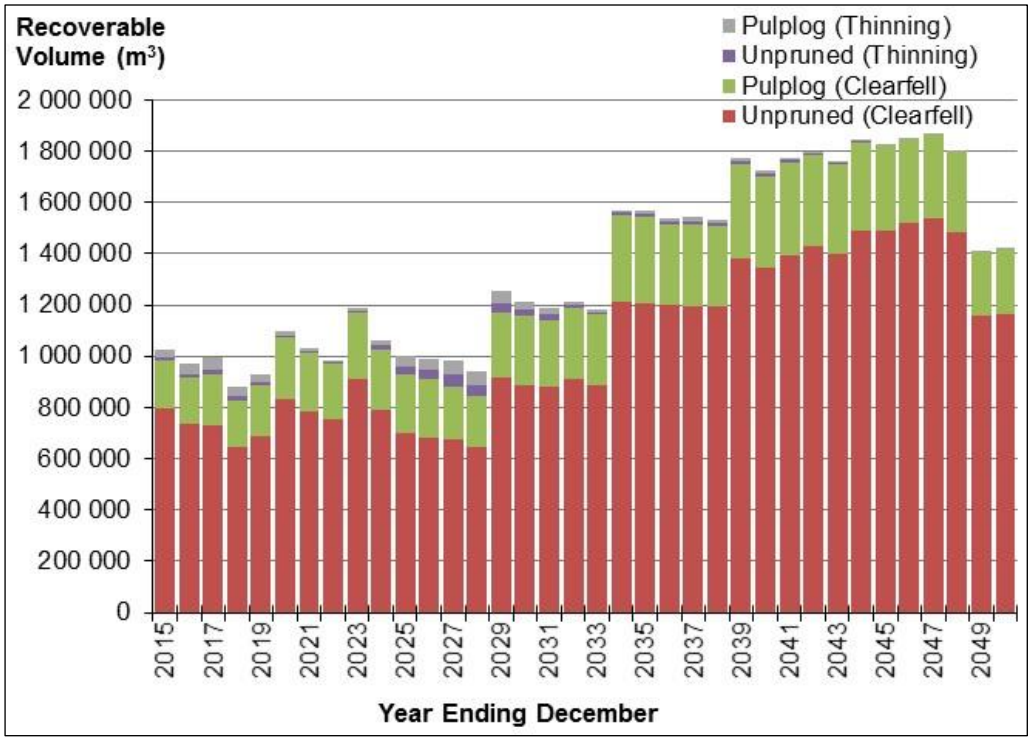


Figure 4-16: New Zealand Douglas-fir Wood Availability by Log Grade – All Owners



4.6 Scenario 6: Minor Species

The total *modelled*[16] net stocked area for minor species was estimated to be 60 283 ha (as at the applicable NEFD modelling date – see Table 3-1).

In the NEFD, minor species are classified into the following groups:

A. Cypress (i.e. macrocarpa, lusitanica, and all other cypress species)

B. Other Softwoods (i.e. various pine, fir, larch, redwood, and cedar species, etc.; and excluding radiata pine and Douglas-fir)

C. Eucalypts (i.e. *Eucalyptus nitens*, *E. fastigata*, *E. regnans*, and all other eucalypt species)

D. Other Hardwoods (i.e. acacia, walnut, oak, poplar, willow, paulownia, birch, alder, and elm, etc.)

The potential harvest profile is highly dependent on the underlying age-class distribution of each minor species group, and these are presented in Figure 4-17 to Figure 4-20 respectively. It can be seen that the age-class distributions are mostly irregular within each minor species group.

Scenario 6A to 6D are very similar to Scenario 1 for radiata pine, except they are developed for the four minor species groups, where large-scale owners' wood availability is based on stated harvest intentions for the period 2015 to 2023. After 2023, a modelling assumption is that the wood availability from large-scale owners will not decrease.

Small-scale owners are assumed to harvest their forest holdings at various target rotation ages (Table 3-2 in Section 3.4.2).

[16] i.e. after adjustments to the area as described in Section 3.1

Figure 4-17: Age-Class Distribuiton of New Zealand Cypress as at 1 April 2015 – All Owners

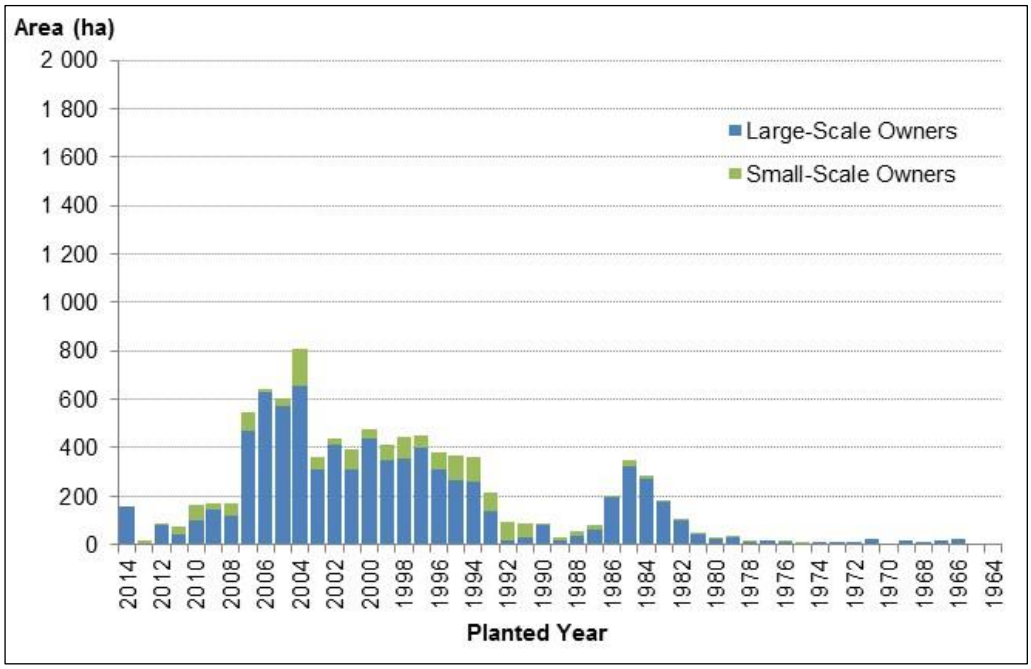


Figure 4-18: Age-Class Distribuiton of New Zealand Other Softwoods as at 1 April 2015 – All Owners

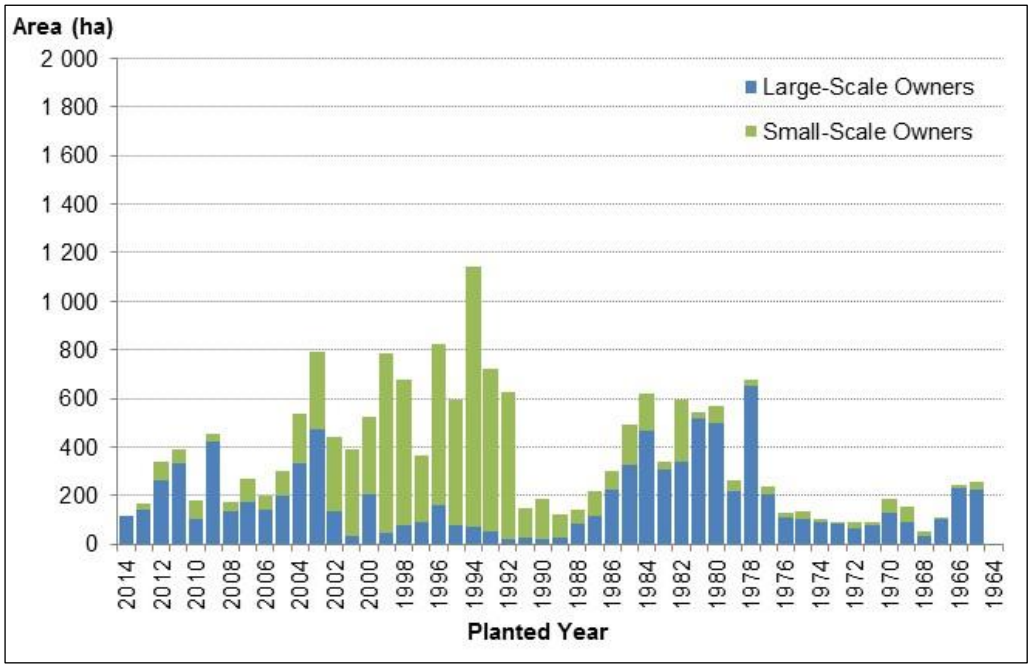


Figure 4-19: Age-Class Distribution of New Zealand Eucalypts as at 1 April 2015 – All Owners

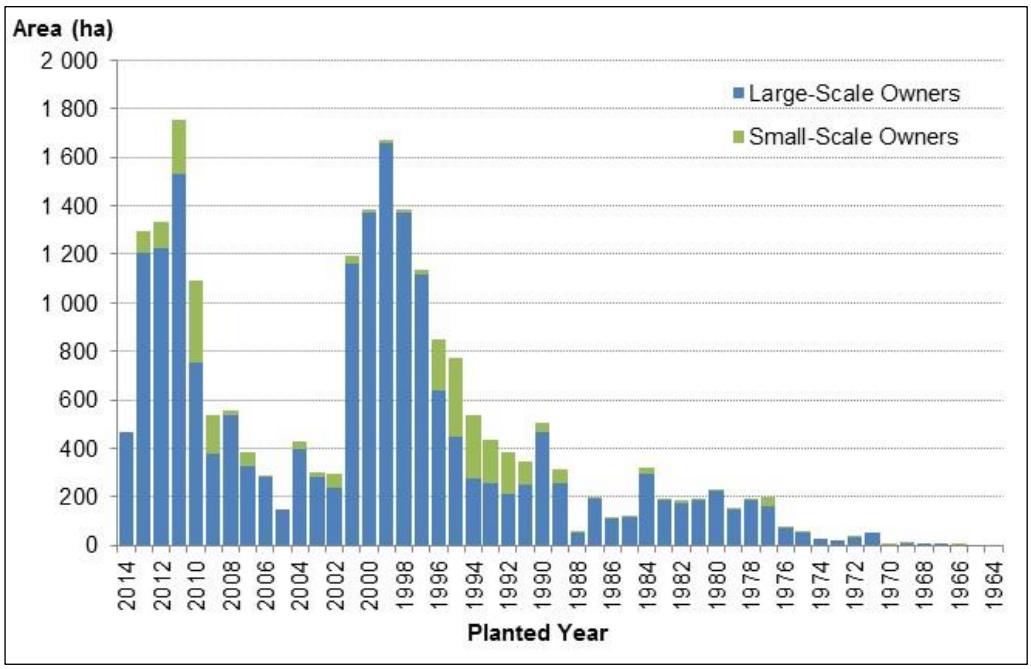
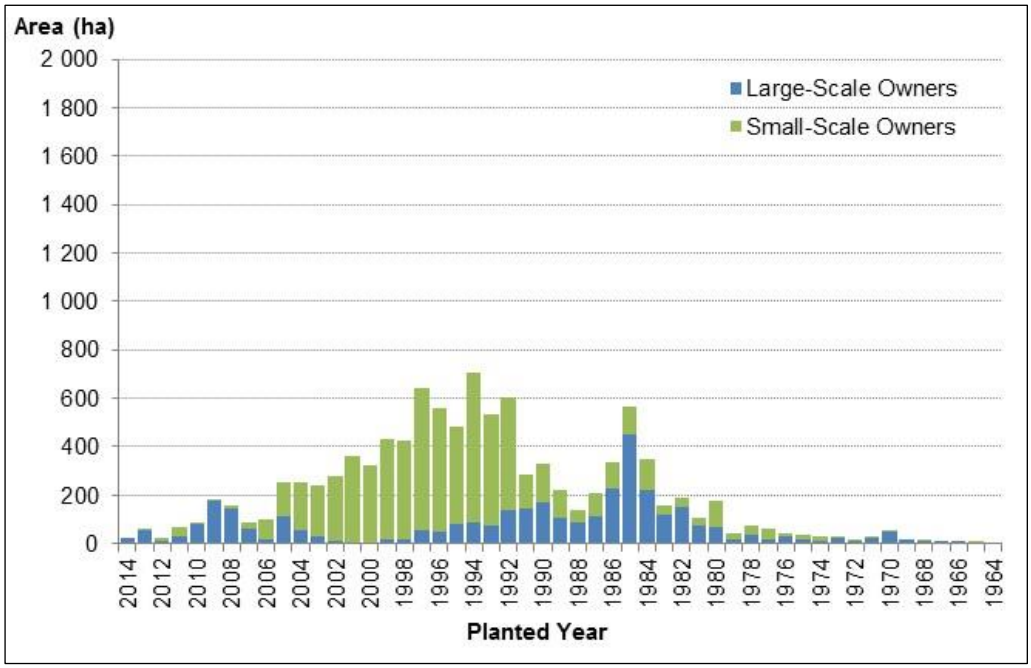


Figure 4-20: Age-Class Distribution of New Zealand Other Hardwoods as at 1 April 2015 – All Owners



4.6.1 Cypress Wood Availability (Scenario 6A)

Figure 4-21 presents the national WAFs for cypress. Most of the large-scale cypress owners are not intending to harvest their estates before 2024 according to their harvest intentions. The forecasts show that the wood availability of cypress will be primarily coming from the large-scale owners (at around 100 000 m^3 per annum) after 2023 as the majority of the national cypress plantations are owned by large-scale owners.

The average clearfell age of cypress by ownership category under Scenario 6A is presented in Figure 4-22. In order for the large-scale owners to maintain a non-declining yield harvest profile, the large-scale owners' estate will need to be harvested at a clearfell age which is much older than the target rotation of 35 years, especially from in the 2040s, whereas the average clearfell age of small-scale owners is very close to the target rotation of 35 years.

Figure 4-21: Cypress Wood Availability Under Scenario 6A

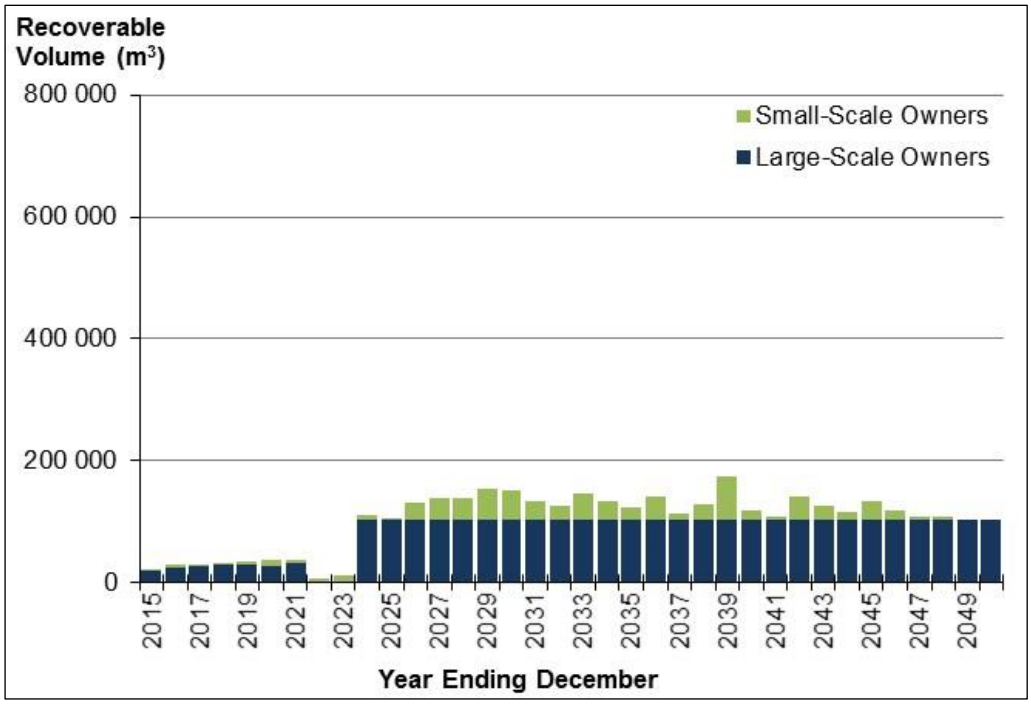
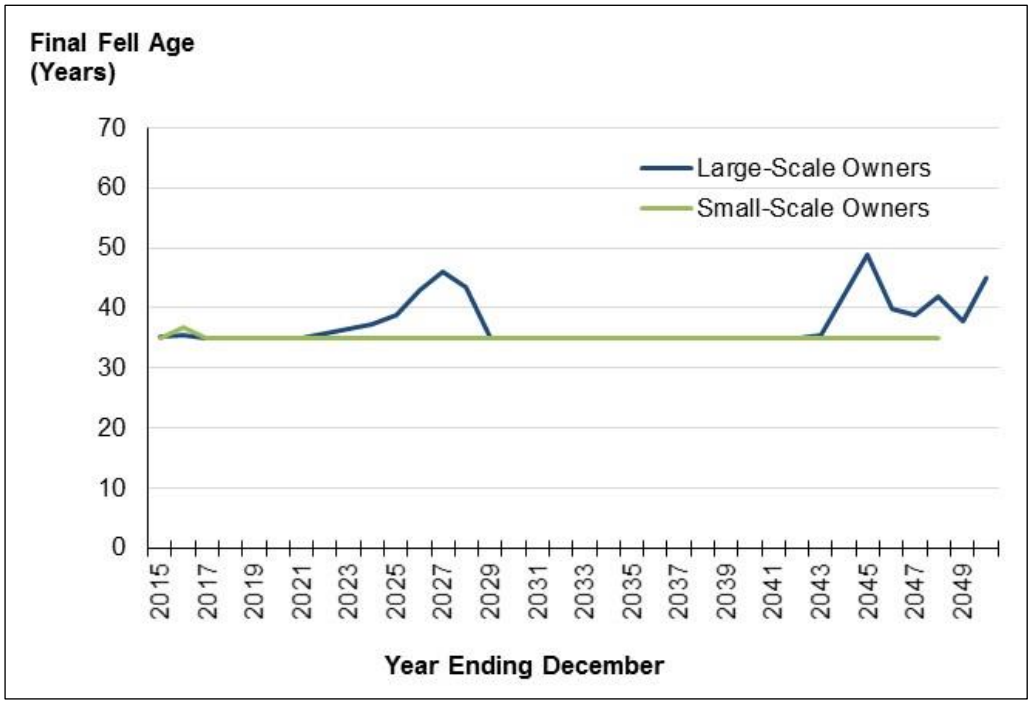


Figure 4-22: Average Cypress Clearfell Age Under Scenario 6A



4.6.2 Other Softwoods Wood Availability (Scenario 6B)

Figure 4-23 presents the national WAFs for other softwoods. The national wood availability of other softwoods from the large-scale owners is expected to be between 100 000 and 170 000 m^3 per annum between 2015 and 2021 as many of the large-scale owners' estates that were planted in the 1980s are reaching maturity. However, it is expected to decline in 2022 and 2023. After 2023, the wood availability of other softwoods from the large-scale owners is expected to be around 116 000 m^3 per annum, along with an increasing wood availability coming from the small-scale owners.

The average clearfell age of other softwoods by ownership category under Scenario 6B is presented in Figure 4-24. In order for the large-scale owners to maintain a non-declining yield harvest profile after 2023, the large-scale owners' estate will need to be harvested at a clearfell age which is much older than the target rotation of 35 years.

Figure 4-23: Other Softwoods Wood Availability Under Scenario 6B

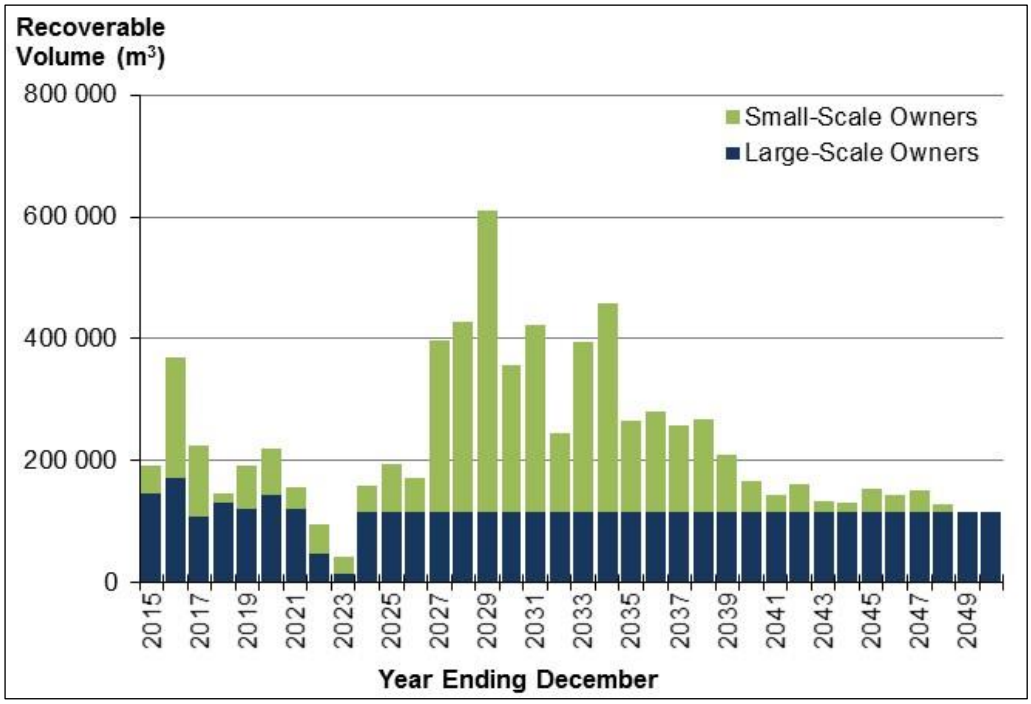
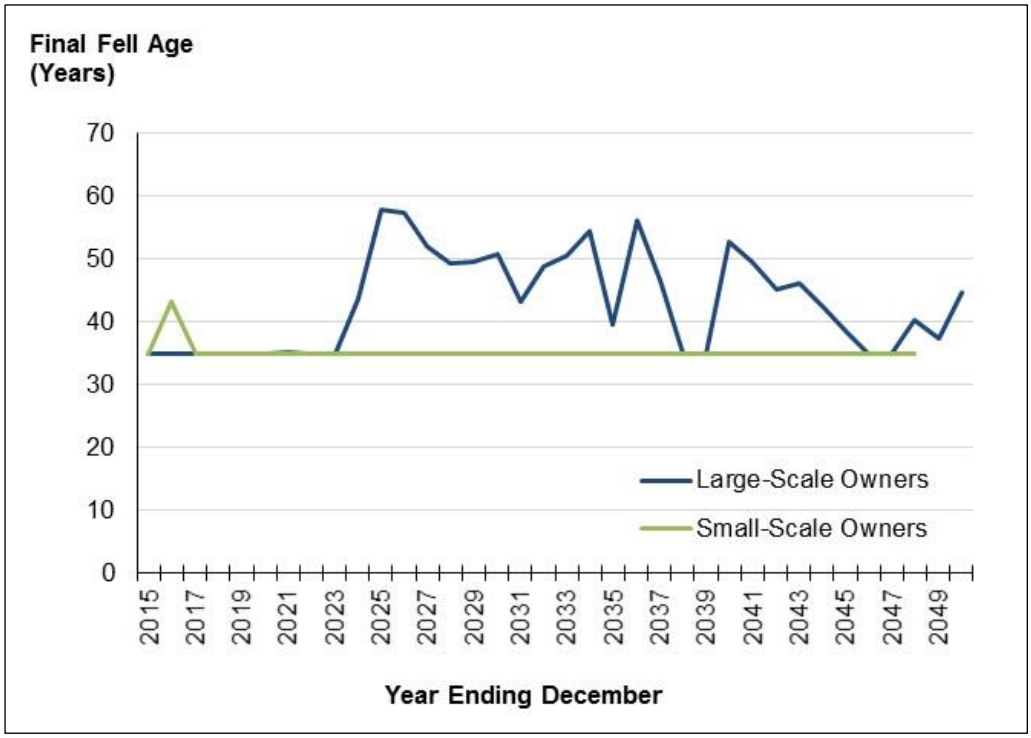


Figure 4-24: Average Other Softwoods Clearfell Age Under Scenario 6B



4.6.3 Eucalypts Wood Availability (Scenario 6C)

Figure 4-25 presents the national WAFs for eucalypts. The wood availability of eucalypts is primarily coming from the large-scale forest owners, and is expected to be around 300 000 m^3 per annum between 2015 and 2023 and reaching a non-declining yield at approximately 340 000 m^3 per annum from 2024.

The large-scale forest owners in the North Island stated in the harvest intentions that they are going to harvest their estates at a rotation age of between 10 and 20 years, while the large-scale owners in the South Island intend to harvest their estates at between 20 and 30 years. As a consequence, the average clearfell age of eucalypts by ownership category under Scenario 6C (Figure 4-26) shows the average clearfell age fluctuating widely for both large-scale and small-scale owners. In order to maintain a non-declining yield harvest profile after 2023, the large-scale owners' estate will need to be harvested at a clearfell which is close to 40 years at times. This is due to the irregular age-class distribution (Figure 4-19) of the resource.

Figure 4-25: Eucalypts Wood Availability Under Scenario 6C

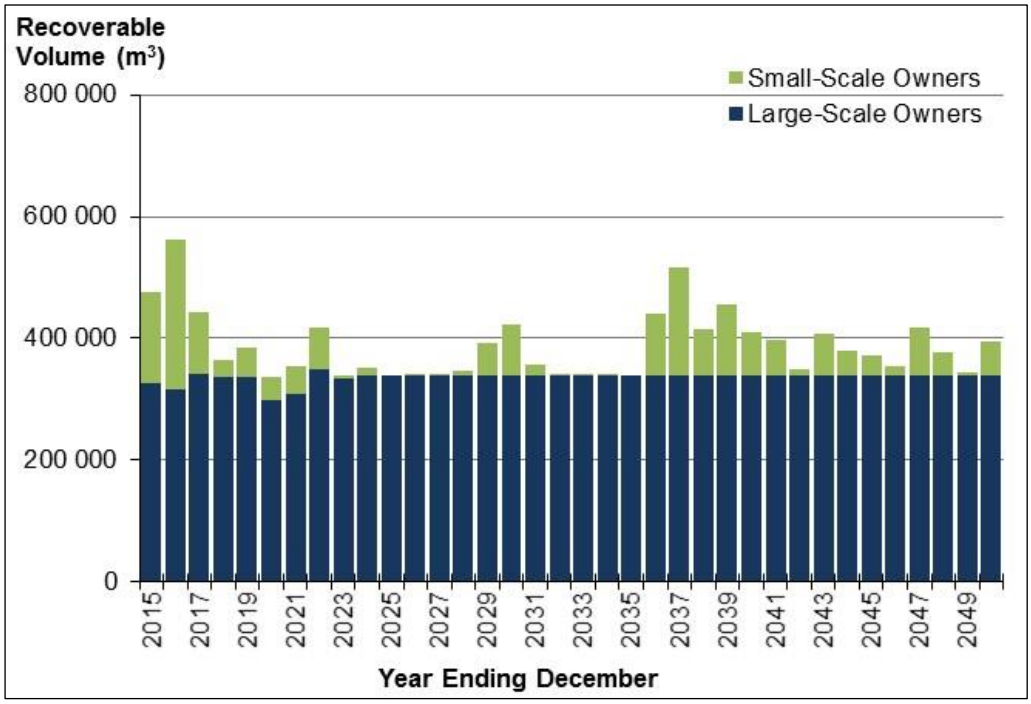
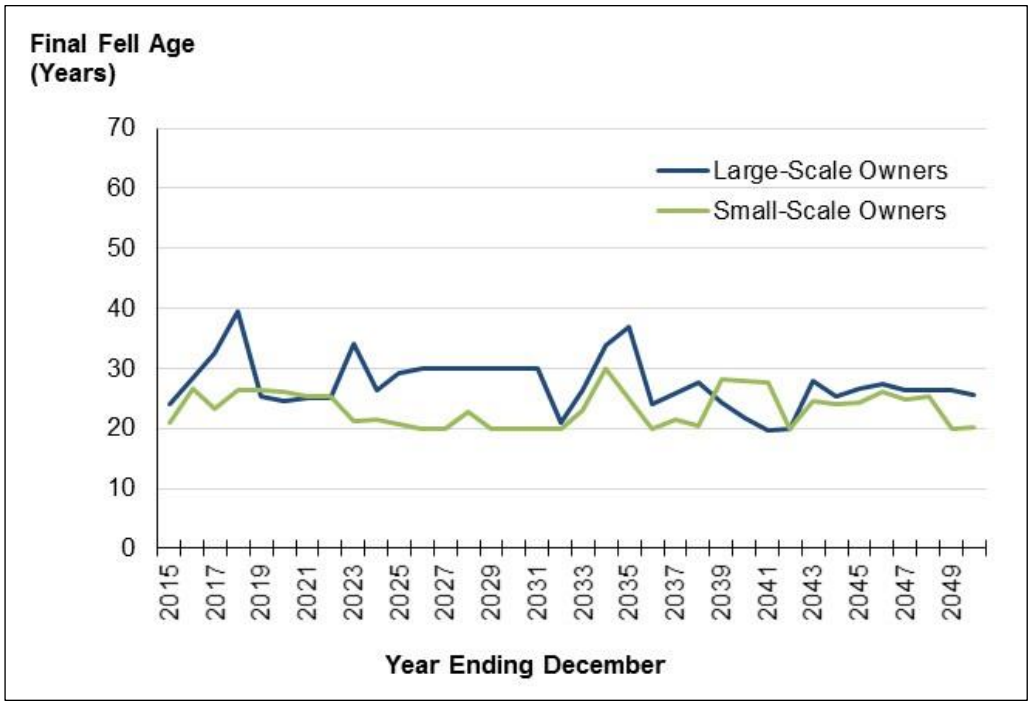


Figure 4-26: Average Eucalypts Clearfell Age Under Scenario 6C



4.6.4 Other Hardwoods Wood Availability (Scenario 6D)

The forest description and harvest intentions applicable to the other hardwoods estate is not well-understood. It is likely to be a combination of short-rotation hardwood species such as acacia, birch, poplar, willow, and paulownia; and some longer rotation hardwood species such as walnut, oaks, and elm.

Figure 4-27 presents the national WAFs for other hardwoods. It can be seen that most of the supply is likely to come from the small-scale owners. It should be stressed that Figure 4-27 represents the theoretical wood availability of this species group; the very large harvest level showing in 2016 is due to the age-class distribution of the species, and the harvest age constraints applied in the modelling.

The average clearfell age of other hardwoods by ownership category under Scenario 6D is presented in Figure 4-28. Considerable variance in harvest age is apparent.

Figure 4-27: New Zealand Other Hardwoods Wood Availability Under Scenario 6D

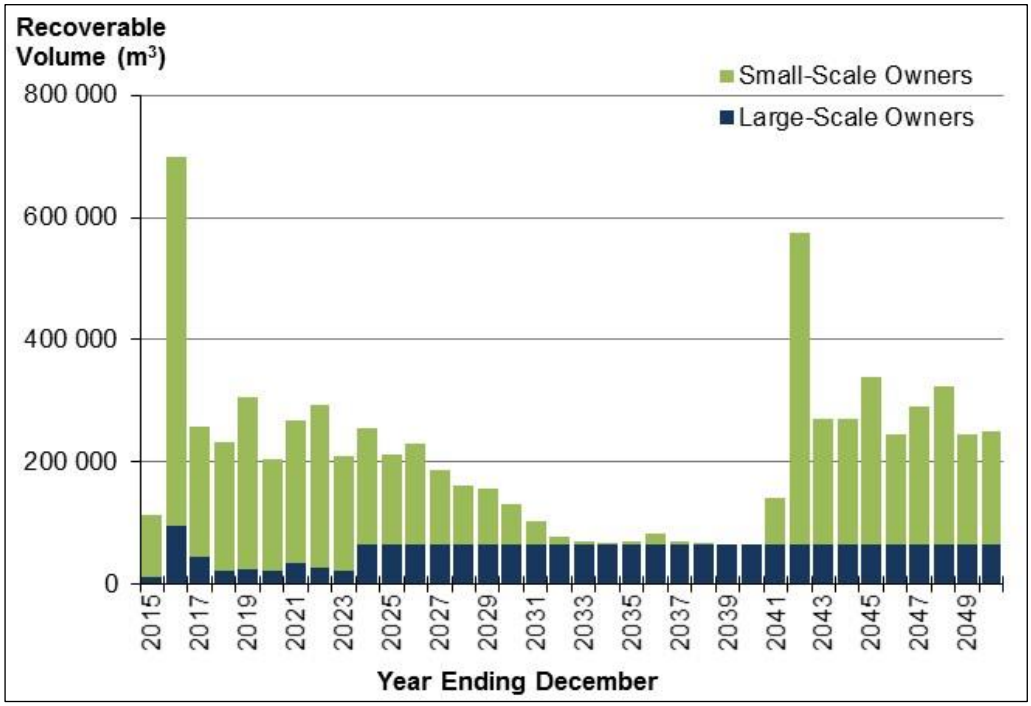
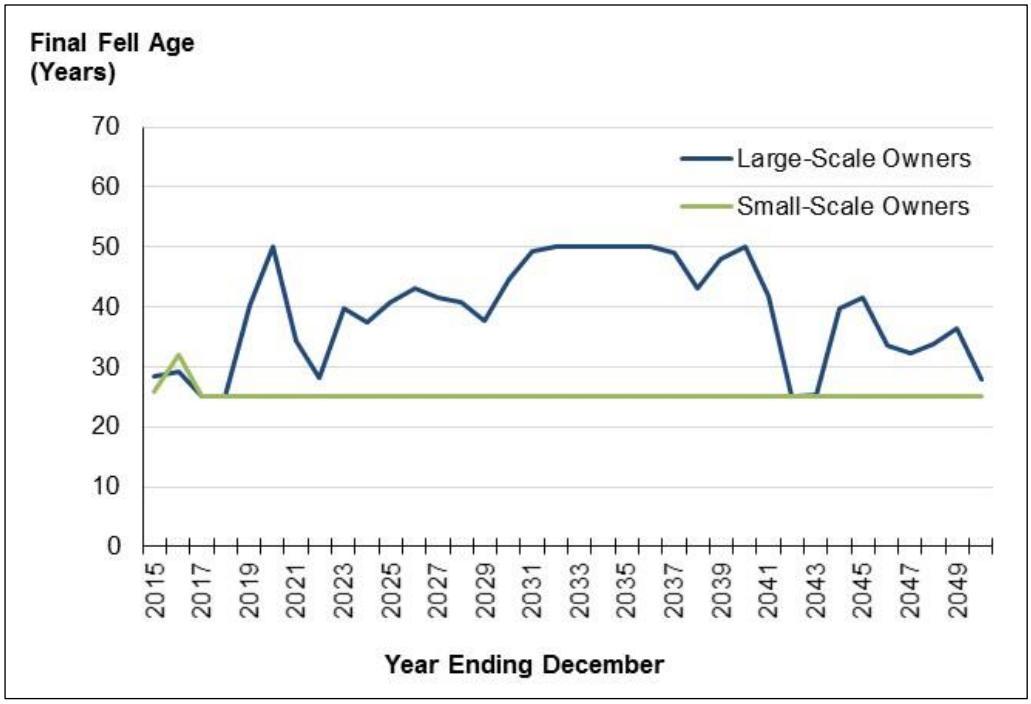


Figure 4-28: Average Other Hardwoods Clearfell Age Under Scenario 6D



4.6.5 Scenario 7: Minor Species (Non-declining Yield)

Scenario 7 results are shown in Appendix 1

5. ADDITIONAL ANALYSIS

5.1 Comparison of the 2008 and 2014 WAFs (Radiata Pine)

The unadjusted areas of radiata pine in the 2014 forecasts have reduced from those used in the 2008 forecasts, especially in the Northland and Canterbury regions (Table 5-1). However, the potential future harvest levels are very similar to the 2008 WAFs (Figure 5-1 and Figure 5-2). This is because the latest forecasts are based on higher overall productivity assumptions:

- A greater proportion of the radiata pine estate is moving into the post-1989 age group, which is expected to have a higher productivity on a cubic metre per hectare basis than the pre-1990 age group (Figure 5-4).
- A greater proportion of the radiata pine estate has moved (and will move after replanting) from a pruned silvicultural regime into an unpruned silvicultural regime. In general, the latter shows a higher yield per hectare due to greater final crop stockings than the pruned regimes.

As described in Section 3.4.2, the target rotation age for the main scenarios was 30 years in the 2008 WAF, and this has reduced 28 years in the latest WAF.

Table 5-1: Planted Area – Radiata Pine (Previous vs Current Forecasts)

Region	2008 WAF Unadjusted NEFD Area (ha)[17]	2014 WAF Unadjusted NEFD Area (ha)[18]	Area Variance (ha)	% Change
Northland	205 196	186 320	-18 876	-9%
Central North Island	551 339	555 144	3 805	1%
East Coast	150 777	151 139	362	0%
Hawkes Bay	128 811	128 841	30	0%
Eastern Southern North Island	66 939	66 124	-815	-1%
Western Southern North Island	95 855	91 154	-4 701	-5%
Total North Island	***1 198 917***	***1 178 722***	***-20 195***	***-2%***
Nelson	86 563	85 820	-743	-1%
Marlborough	70 733	70 317	-416	-1%
West Coast	23 095	22 451	-644	-3%
Canterbury	88 596	72 546	-16 050	-18%
Otago	93 718	86 755	-6 963	-7%
Southland	46 522	43 591	-2 931	-6%
Total South Island	***409 227***	***381 480***	***-27 747***	***-7%***
Total New Zealand	**1 608 144**	**1 560 202**	**-47 942**	**-3%**

[17] Based on NEFD areas available for each region at the time the forecast was produced (2005-08)

[18] Based on NEFD areas available for each region at the time the forecast was produced (2013-15)

Figure 5-1: Scenario 1 (2014 Forecasts) vs Scenario 2 (2008 Forecasts)

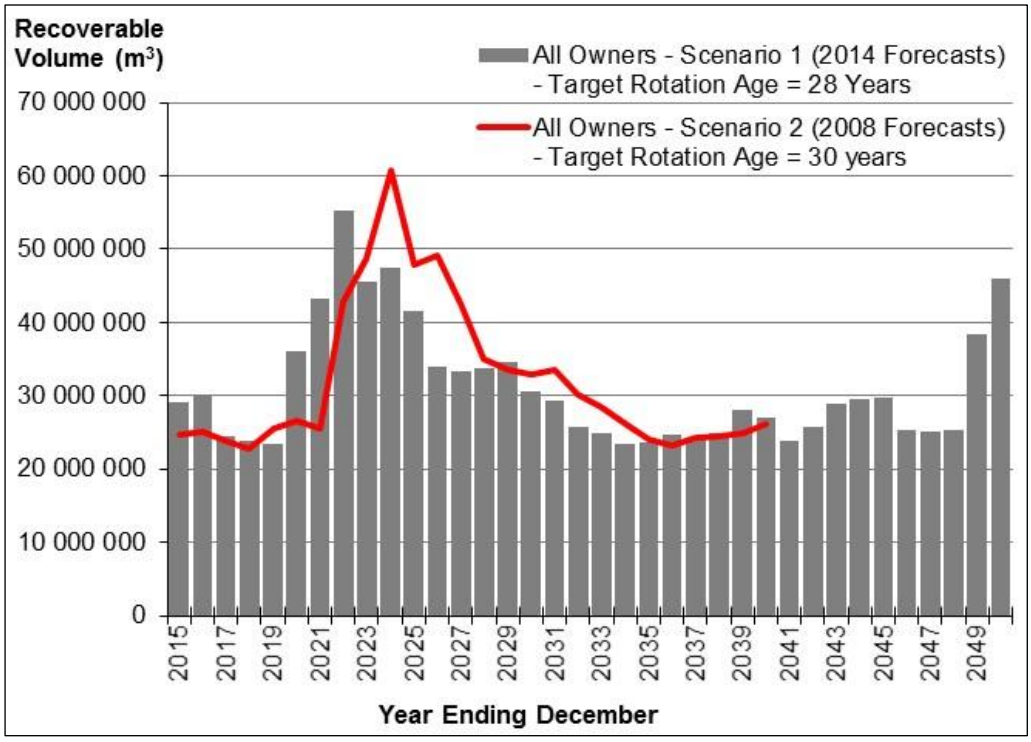


Figure 5-2: Scenario 2 (2014 Forecasts) vs Scenario 3 (2008 Forecasts)

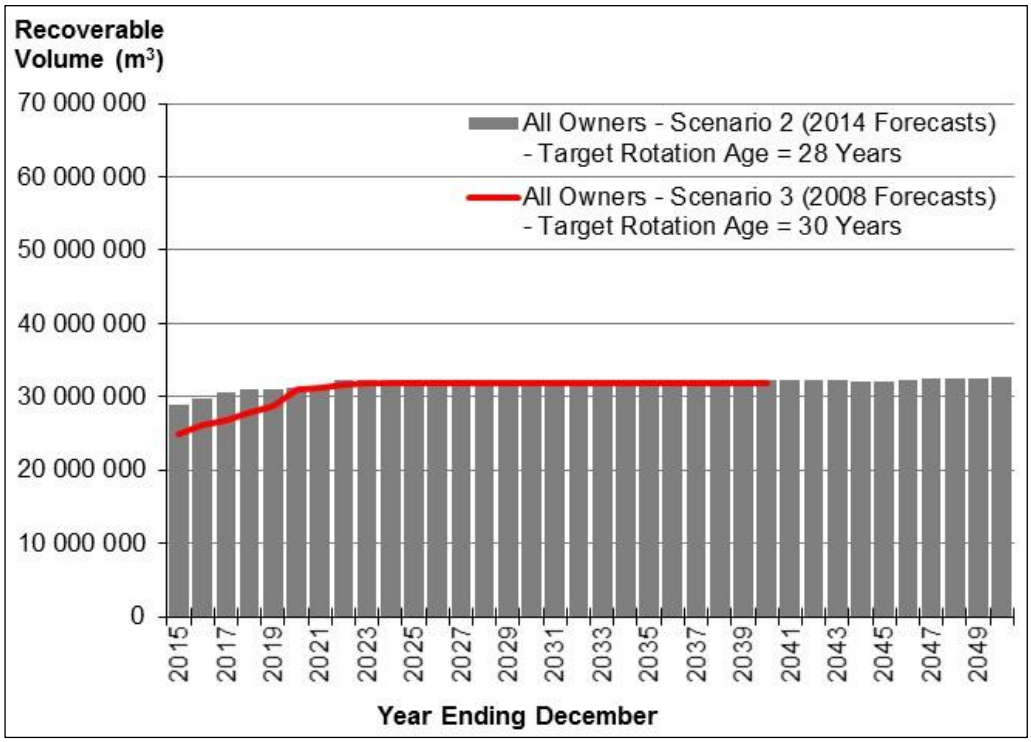
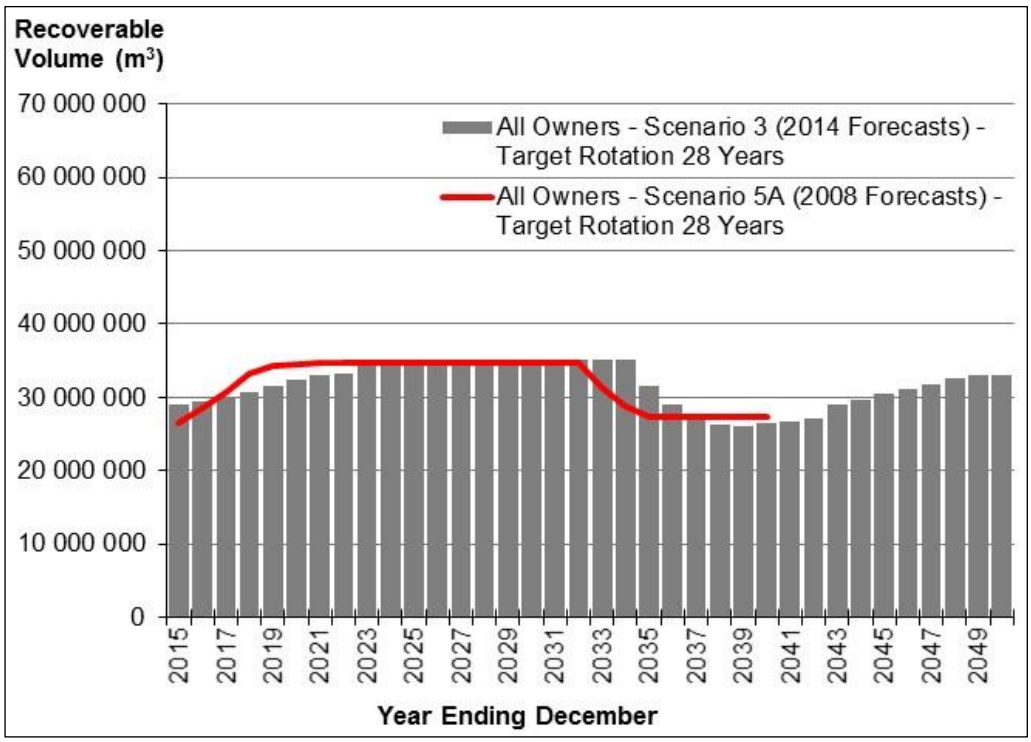


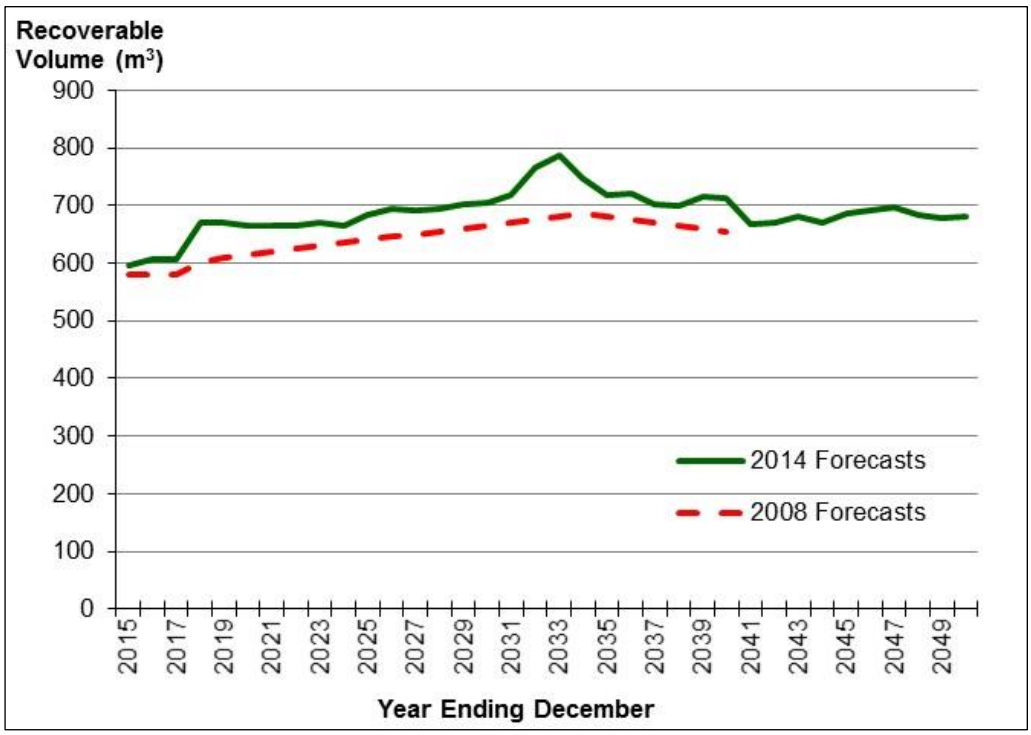
Figure 5-3 compares the results from Scenario 3 in the 2014 forecasts against Scenario 5A in the 2008 forecasts, where both scenarios are based on a target rotation of 28 years.

Figure 5-3: Scenario 3 (2014 Forecasts) vs Scenario 5A (2008 Forecasts)[19]



[19] The NDY constraint was applied through to 2032 in the 2008 WAF, and 2034 in the 201 WAF.

Figure 5-4: Average Radiata Pine Clearfell Recoverable Volume per Hectare Under Scenario 3 – All Owners



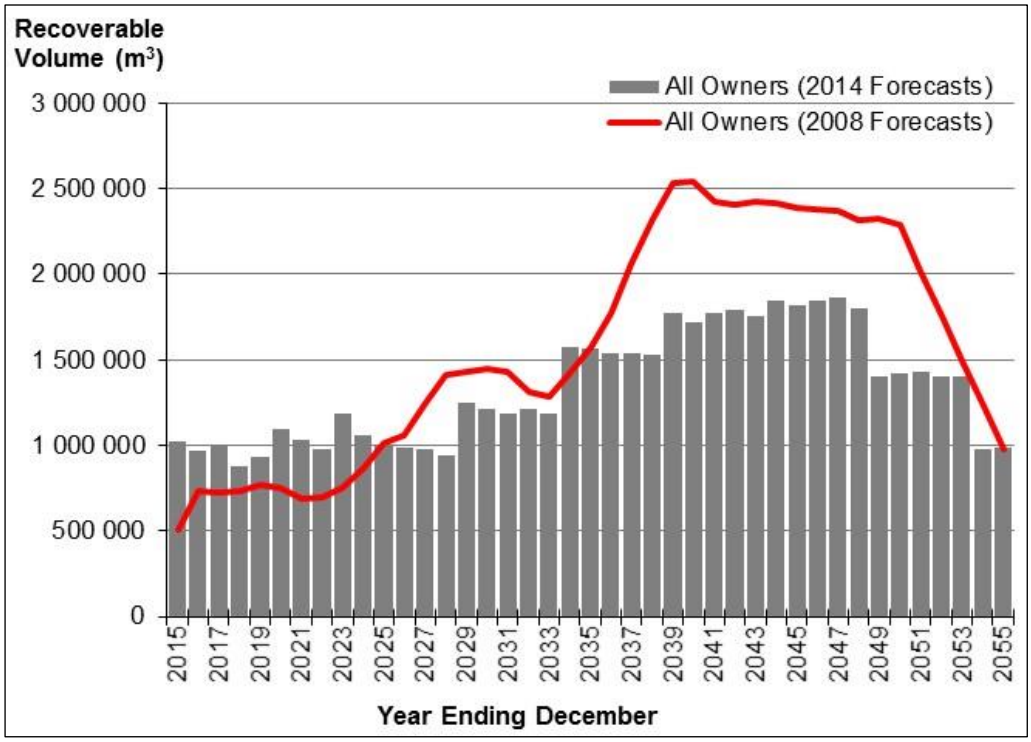
5.2 Comparison of the 2008 and 2014 WAFs (Douglas-fir)

The unadjusted area of Douglas-fir used in the 2014 forecast is 6% less than the area used in the 2008 forecast. Area reductions are largest in Southland, Nelson, and the Central North Island (Table 5-2). In addition, many of the large-scale forest owners have elected to not replant Douglas-fir apart from some large-scale forest owners in the Otago/Southland, Canterbury and Central North Island regions. As a result, the national wood availability of Douglas-fir from the 2014 forecast is expected to be lower than in the previous forecasts (Figure 5-5).

Table 5-2: Planted Area – Douglas-fir (Previous vs Current Forecasts)

Region	Previous Unadjusted NEFD Area (ha)	Current Unadjusted NEFD Area (ha)	Area Variance (ha)	% Change
Northland	8	10	2	29%
Central North Island	23 270	21 661	-1 609	-7%
East Coast	1 747	1 903	156	9%
Hawkes Bay	1 078	428	-650	-60%
Eastern Southern North Island	677	303	-374	-55%
Western Southern North Island	972	700	-272	-28%
Total North Island	***27 752***	***25 005***	***-2 747***	***-10%***
Nelson	10 108	7 973	-2 135	-21%
Marlborough	2 093	2 133	40	2%
West Coast	1 114	1 451	337	30%
Canterbury	16 614	16 903	289	2%
Otago	28 441	29 696	1 255	4%
Southland	28 974	25 209	-3 765	-13%
Total South Island	***87 344***	***83 365***	***-3 979***	***-5%***
Total New Zealand	**115 096**	**108 370**	**-6 726**	**-6%**

Figure 5-5: Scenario 5 (2014 Forecasts) vs Scenario 6 (2008 Forecasts)[20]



5.3 Comparison of the 2008 and 2014 WAFs (Minor Species)

As WAFs for the minor species were not undertaken in the 2008 forecasts, the comparison is limited to changes in planted areas of these species since 2008.

Table 5-3 shows that since 2005, there has been a decrease in planted area for some of the minor species groups, especially eucalypts in the North Island, but there has been an increase in cypress plantations. Overall, there has been a 20% decline in planted area.

Table 5-3: Planted Area by Minor Species Group

Minor Species Group	North Island / South Island	Unadjusted NEFD Planted Area (ha)		
		2005 NEFD	2015 NEFD	% Change in Area
Cypress	North Island	1 468	2 783	90%
	South Island	4 581	7 340	60%
Other Softwoods	North Island	10 887	8 474	-22%
	South Island	17 210	13 887	-19%
Eucalypts	North Island	19 360	9 667	-50%
	South Island	13 918	13 593	-2%
Other Hardwoods	North Island	11 453	7 523	-34%
	South Island	6 167	4 969	-19%
Total	**New Zealand**	**85 044**	**68 236**	**-20%**

[20] The spike in harvest commencing in 2033 in the 2008 forecast is primarily driven by large areas of young plantations in Otago and Southland regions reaching maturity. Based on regional feed-back, additional smoothing constraints were applied in the 2014 WAF.

6. CONCLUDING COMMENTS

6.1 Radiata Pine and Douglas-fir

When the previous WAF (2008) were produced, the national harvest was around 20 million m^3, and the forecasts indicated this could increase to 32-35 million m^3 by around 2019. There was some speculation as to whether such an increase could be realised. As shown in Figure 1-2, the actual level of roundwood removal increased at a rate even higher than forecast, reaching just over 30 million m^3 by 2015.

Scenario 1 of the latest (2014) forecasts indicates that the harvest level could increase even further from current levels up to 45-55 million m^3, but that this could be sustained for a very short period of time only. The highly regulated scenario 2, suggests a long term sustainable yield of around 32 million m^3 p.a. is achievable (a level very similar to the equivalent 2008 WAF scenario). In between these, scenario 3, shows that the harvest could rise to 34 million m^3 and be sustained at this level through to the mid-2030s.

As mentioned previously in this report, the actual level of future harvest will depend on market conditions, and having suitable infrastructure and supply chains in place to cope with the harvest volumes. The demonstrated rate of increase in the national harvest since 2011 indicates that under favourable market conditions, the supply chain can readily adapt to significant changes in harvest level.

The national harvest level is also highly dependent on the behaviour of the small-scale forest owners. Scenario 2 shows that around one third of the ongoing harvest is from this ownership class. For these owners, there is more uncertainty over the stocked area and yield from their forests. As well, their harvesting activity tends to be more opportunistic and reactive to changes in market conditions than large-scale owners.

A further risk to the forecast wood availability is land conversion at a rate greater than that assumed in Section 3.4.6. This is obviously dependent on the relative economics of forestry versus other land uses.

Since the previous WAFs were produced in 2008, the national estate has declined in area through deforestation, but yield expectations have improved, with the net result being a very similar long term harvest availability. Of note also is that the proportion of area under the unpruned radiata pine croptype has increased, with a corresponding reduction in both the pruned radiata pine and Douglas-fir croptypes.

6.2 Minor Species

Minor species harvest volumes make up a small proportion of the national harvest, although at a regional level they may be significant (such as eucalypts in Southland). There has been a significant increase in the area of cypress species planted since the 2008 WAFs were undertaken, although the area of other minor species groups has declined. Cypress and eucalypts are the only minor species groups that have been planted at an industrial scale by large-scale owners.

The harvest of cypress has the potential to reach levels of over 100 000 m^3 p.a. by the mid-2020s. Supply is mainly dominated by the large-scale owners (85%). The wood availability of eucalypts from large-scale owners is expected to fluctuate in the next ten years before reaching a long-term sustainable level at around 340 000 m^3 p.a. after 2023. This supply also is dominated by the large-scale owners.

There is considerable uncertainty over the wood availability of other softwoods and hardwoods. Ownership is dominated by small-scale forest owners, and in comparison to the more mainstream species, yield table development is at a basic level only. Based on the assumptions used in the current WAF, each species group could provide a long-term harvest level of around 200 000 m^3 p.a.

7. REFERENCES

Ministry for Primary Industries (2016) National Exotic Forest Description as at 1 April 2015.

Ministry for Primary Industries (2015) National Exotic Forest Description as at 1 April 2014.

Ministry for Primary Industries (2014) National Exotic Forest Description as at 1 April 2013.

Appendix 1

Scenario 7: Minor Species

MINOR SPECIES SCENARIO 7

Description of Scenario

Scenario 7A to 7D are very similar to Scenario 2 for radiata pine, except they are developed for the four minor species groups, where large-scale owners' wood availability is based on the stated harvest intentions for the period 2015 to 2023. After 2023, a modelling assumption is that the wood availability from large-scale owners will not decrease. In addition, the total national wood availability of the combined estate is also modelled to be non-declining for each minor species group.

Cypress Wood Availability (Scenario 7A)

Figure A-1 presents the national WAFs for cypress (Scenario 7A). The availability from both large-scale and small-scale owners could reach a non-declining yield at around 122 000 m^3 per annum after 2023, primarily coming from the large-scale owners.

The average clearfell age of cypress by ownership category under Scenario 7A is presented in Figure A-2. In order for the national cypress estate to maintain a non-declining yield harvest profile, the large-scale owners' estate will need to be harvested at a clearfell age which is much older than the target rotation of 35 years, especially in the 2040s.

Figure A-1: Cypress Wood Availability Under Scenario 7A

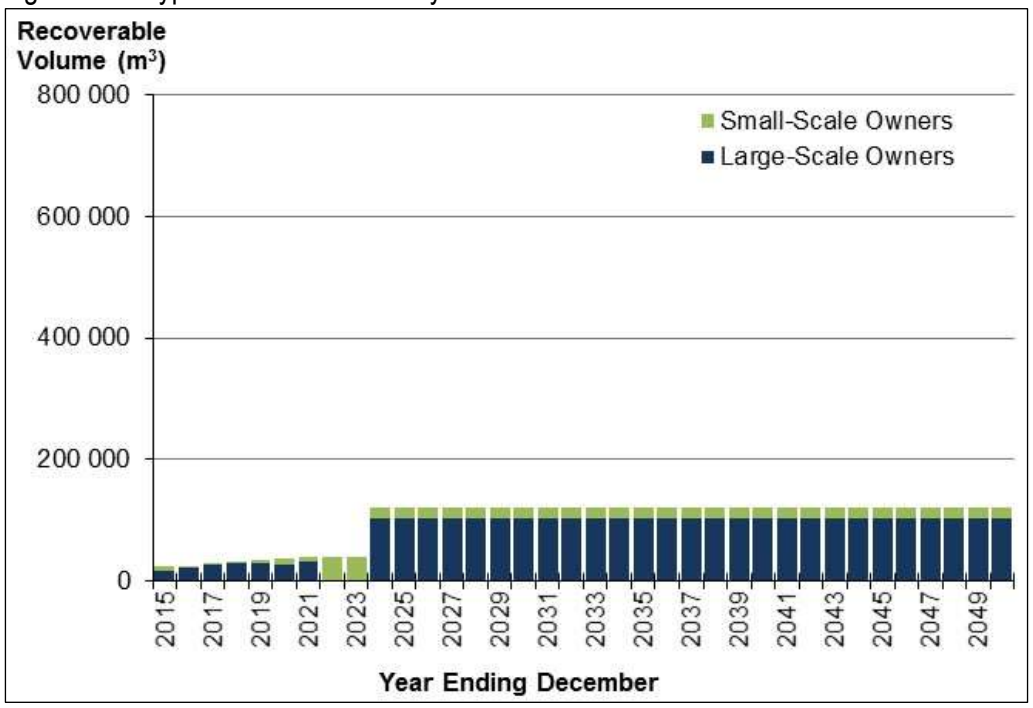


Figure A-2: Average Cypress Clearfell Age Under Scenario 7A

Other Softwoods Wood Availability (Scenario 7B)

Figure A-3 presents the national WAFs for other softwoods (Scenario 7B). The availability from both large-scale and small-scale owners could reach a non-declining yield at around 229 000 m^3 per annum after 2023.

The average clearfell age of other softwoods by ownership category under Scenario 7B is presented in Figure A-4. In order for the national other softwoods estate to maintain a non-declining yield harvest profile, the large-scale owners' estate will need to be harvested at a clearfell age which is much older than the target rotation of 35 years.

Figure A-3: Other Softwoods Wood Availability Under Scenario 7B

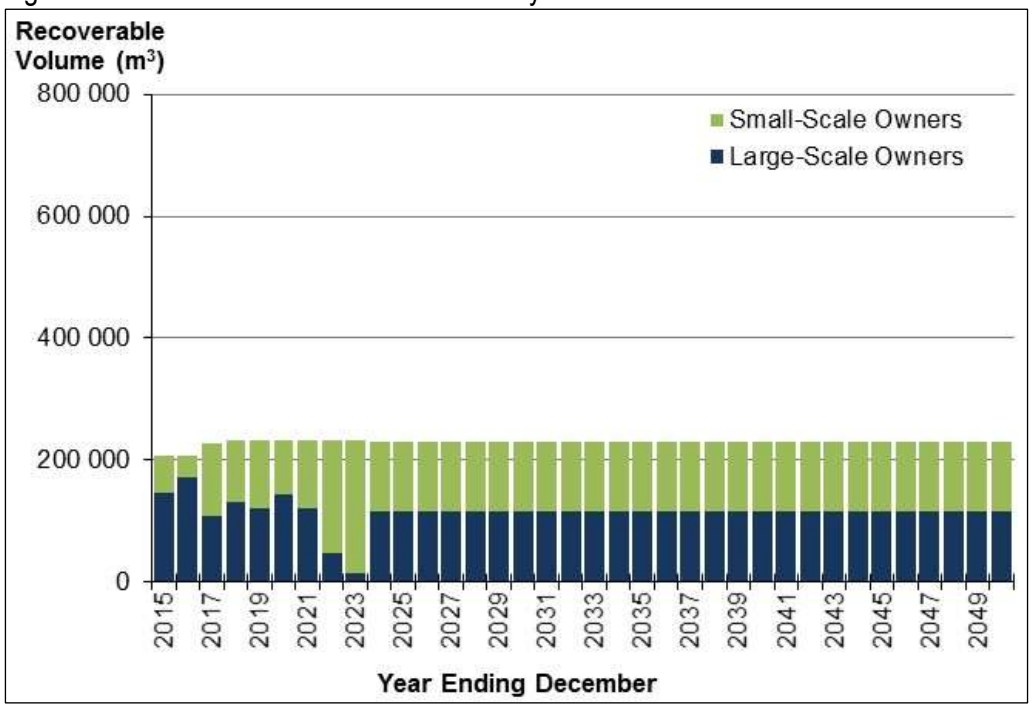
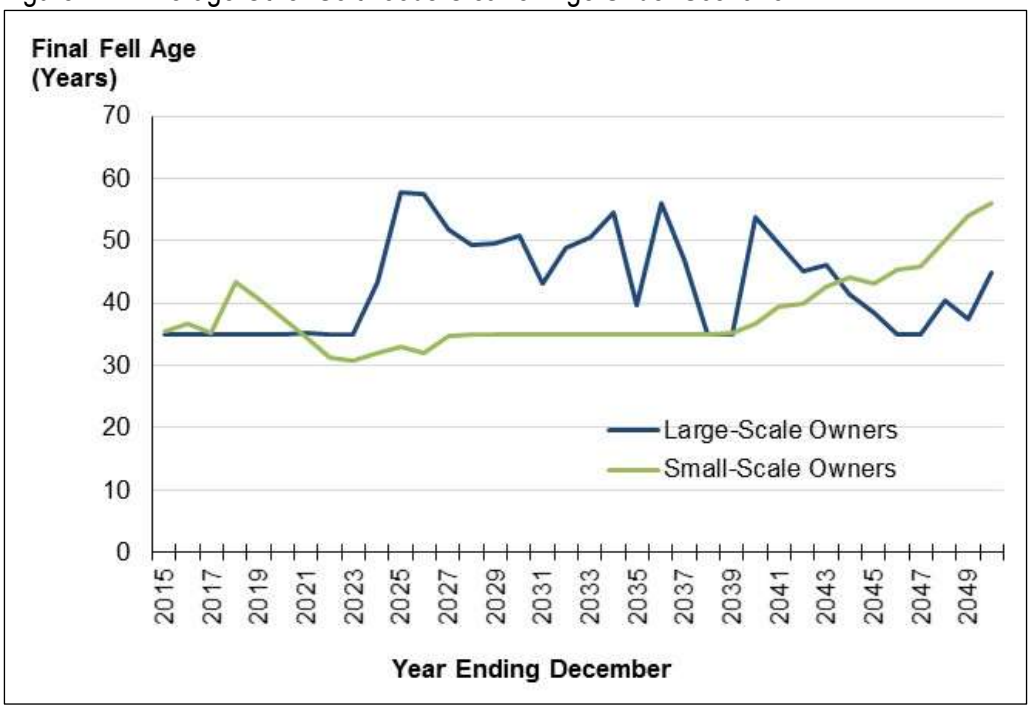


Figure A-4: Average Other Softwoods Clearfell Age Under Scenario 7B



Eucalypts Wood Availability (Scenario 7C)

Figure A-5 presents the national WAFs for eucalypts (Scenario 7C). The availability from both large-scale and small-scale owners could reach a non-declining yield at around 386 000 m^3 per annum after 2023, primarily coming from the large-scale owners.

The average clearfell age of eucalypts by ownership category under Scenario 7C is presented in Figure A-6. In order for the national eucalypts estate to maintain a non-declining yield harvest profile, the national eucalypts estate will need to be harvested at a clearfell age which is close to 40 years in some years due to the highly irregular age-class distribution.

Figure A-5: Eucalypts Wood Availability Under Scenario 7C

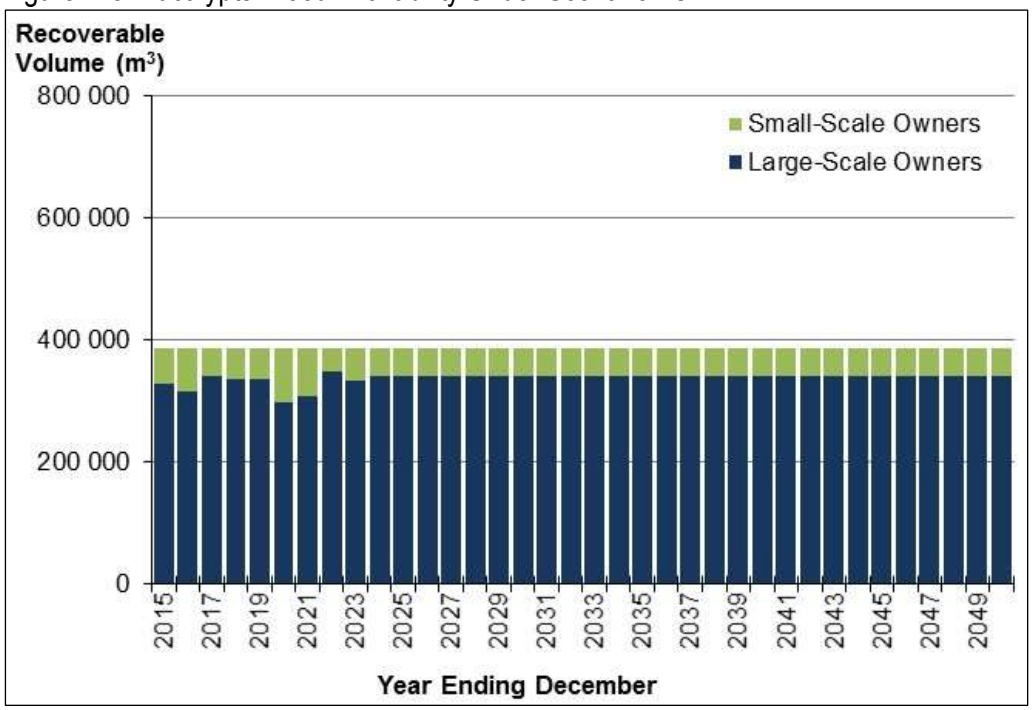
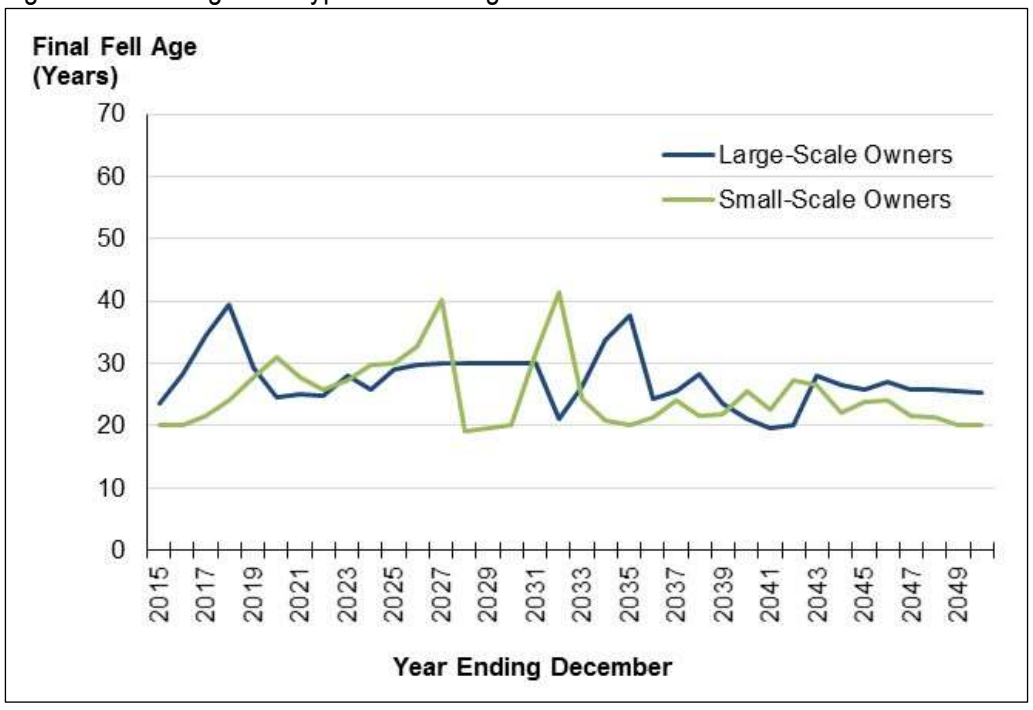


Figure A-6: Average Eucalypts Clearfell Age Under Scenario 7C



Other Hardwoods Wood Availability (Scenario 7D)

Figure A-7 presents the national WAFs for other hardwoods (Scenario 7D). The availability from both large-scale and small-scale owners could reach a non-declining yield at around 190 000 m^3 per annum after 2023.

The average clearfell age of other hardwoods by ownership category under Scenario 7D is presented in Figure A-8. In order for the national other hardwood estate to maintain a non-declining yield harvest profile, the national other hardwoods estate will need to be harvested at a clearfell age which is close to 50 years in some years due to the highly irregular age-class distribution.

Figure A-7: Other Hardwoods Wood Availability Under Scenario 7D

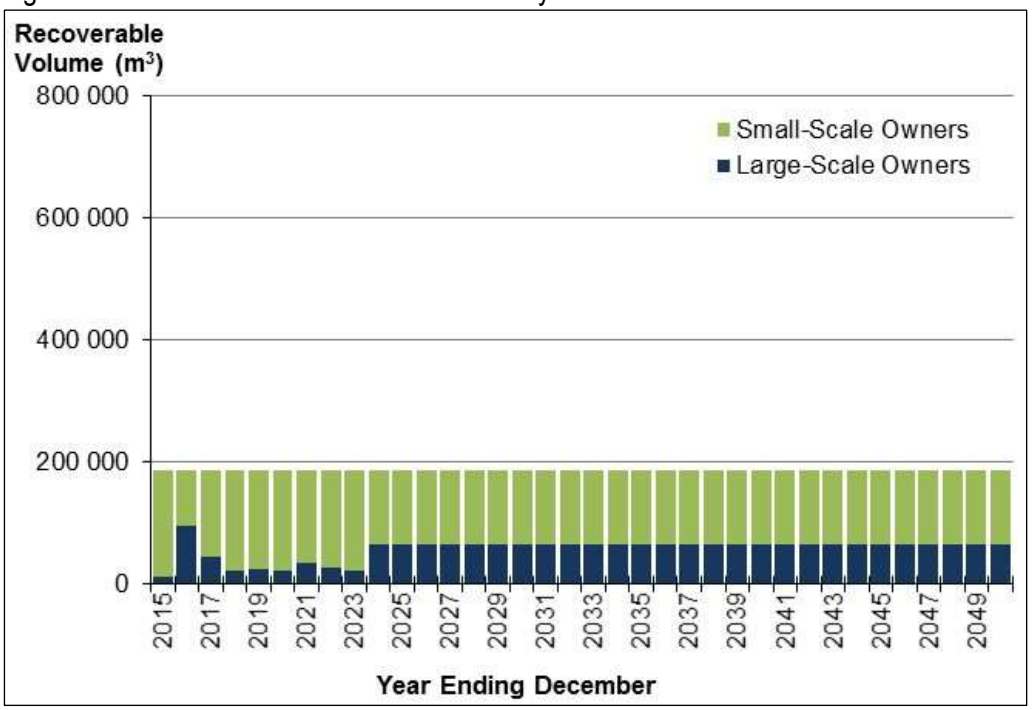
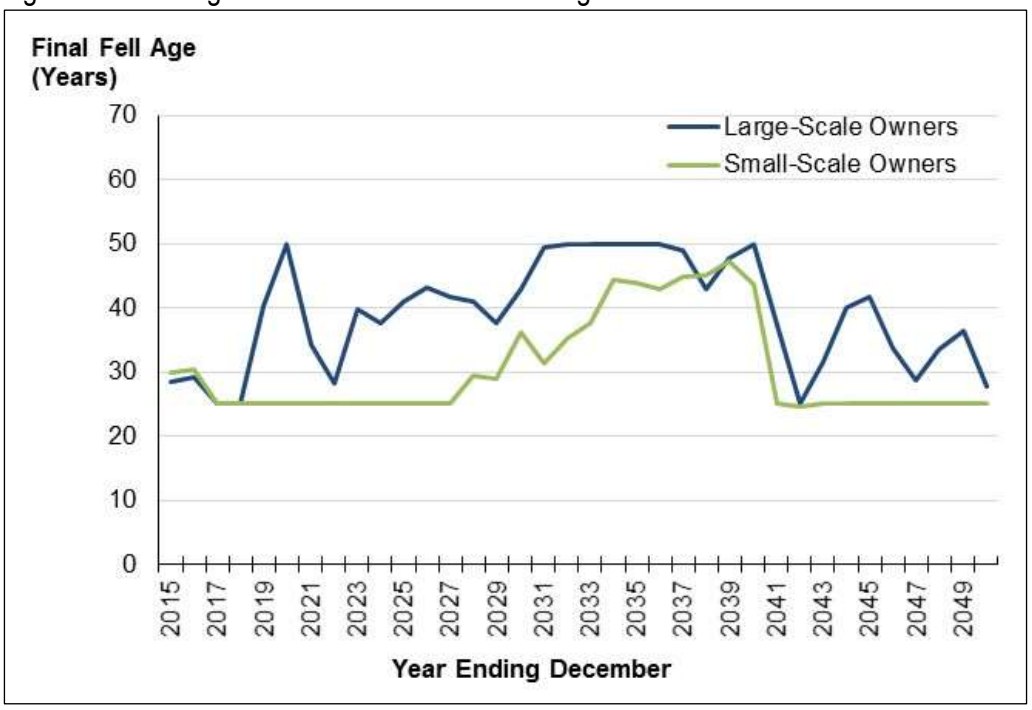


Figure A-8: Average Other Hardwoods Clearfell Age Under Scenario 7D



Appendix 2

Wood Availability Forecasts New Zealand 2014–2050

New Zealand Wood Availability Forecasts under Scenario 1 for radiata pine (Figures 2-1 and 4-4)

Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and small-scale owners harvest at age 28 years.

Year Ending December	Large-Scale Owners (000 m3 IB)	Small-Scale Owners (000 m3 IB)	All Owners (000 m3 IB)
2015	21 640	7 482	29 122
2016	21 238	8 812	30 050
2017	21 141	3 424	24 564
2018	20 787	3 077	23 864
2019	20 098	3 294	23 392
2020	19 706	16 286	35 993
2021	19 096	24 050	43 146
2022	19 234	36 059	55 293
2023	19 491	26 067	45 558
2024	20 994	26 481	47 475
2025	21 431	20 088	41 519
2026	21 523	12 527	34 050
2027	21 596	11 792	33 388
2028	21 506	12 199	33 706
2029	21 515	13 122	34 637
2030	21 655	8 959	30 614
2031	21 655	7 693	29 349
2032	21 655	3 979	25 634
2033	21 690	3 232	24 922
2034	21 746	1 766	23 512
2035	21 869	1 859	23 728
2036	22 097	2 478	24 575
2037	22 292	1 904	24 197
2038	22 292	2 681	24 973
2039	22 292	5 820	28 112
2040	22 292	4 668	26 960
2041	22 292	1 561	23 853
2042	22 292	3 477	25 769
2043	22 244	6 630	28 874
2044	22 200	7 313	29 513
2045	22 161	7 531	29 692
2046	22 126	3 287	25 413
2047	22 094	3 002	25 096
2048	22 121	3 258	25 379
2049	22 153	16 214	38 367
2050	22 187	23 731	45 918

Notes:
m3 cubic metres inside bark
IB inside bark

New Zealand Wood Availability Forecasts under Scenario 2 for radiata pine (Figures 2-2 and 4-5)

Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and total wood availability is modelled at a non-declining yield.

Year Ending December	Large-Scale Owners (000 m3 IB)	Small-Scale Owners (000 m3 IB)	All Owners (000 m3 IB)
2015	21 584	7 309	28 893
2016	21 127	8 607	29 734
2017	21 150	9 456	30 606
2018	20 814	10 213	31 027
2019	20 146	10 889	31 035
2020	19 687	11 437	31 125
2021	19 116	12 407	31 523
2022	19 171	13 183	32 354
2023	19 491	12 883	32 374
2024	20 736	11 638	32 374
2025	21 080	11 294	32 374
2026	21 332	11 042	32 374
2027	21 449	10 925	32 374
2028	21 501	10 873	32 374
2029	21 646	10 728	32 374
2030	21 747	10 627	32 374
2031	21 747	10 627	32 374
2032	21 747	10 627	32 374
2033	21 747	10 627	32 374
2034	21 789	10 585	32 374
2035	22 015	10 359	32 374
2036	22 076	10 298	32 374
2037	22 138	10 236	32 374
2038	22 354	10 020	32 374
2039	22 395	9 979	32 374
2040	22 395	9 979	32 374
2041	22 395	9 979	32 374
2042	22 395	9 881	32 276
2043	22 347	9 841	32 187
2044	22 317	9 791	32 108
2045	22 276	9 760	32 036
2046	22 240	9 975	32 214
2047	22 240	10 157	32 397
2048	22 240	10 202	32 442
2049	22 272	10 248	32 520
2050	22 272	10 395	32 668

Notes:
m^3 = cubic metres
IB = inside bark.

New Zealand Wood Availability Forecasts under Scenario 3 for radiata pine (Figures 2-3, 4-7 and 4-9)

Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and total wood availability is modelled at a split non-declining yield.

Year Ending December	Large-Scale Owners (000 m3 IB)	Small-Scale Owners (000 m3 IB)	All Owners (000 m3 IB)	Pruned (000 m3 IB)	Unpruned (000 m3 IB)	Chip Logs (000 m3 IB)	Total (000 m3 IB)
2015	21 640	7 380	29 020	4 048	18 744	6 227	29 020
2016	21 238	8 224	29 462	4 013	19 225	6 224	29 462
2017	21 141	8 699	29 840	3 803	19 738	6 299	29 840
2018	20 787	9 845	30 632	4 099	19 938	6 595	30 632
2019	20 098	11 467	31 566	4 146	20 642	6 778	31 566
2020	19 706	12 770	32 477	4 308	21 012	7 156	32 477
2021	19 096	13 835	32 930	4 724	21 154	7 052	32 930
2022	19 234	14 001	33 234	4 819	21 312	7 103	33 234
2023	19 491	14 886	34 376	4 928	22 182	7 266	34 376
2024	20 879	14 185	35 064	5 071	22 609	7 383	35 064
2025	21 181	13 883	35 064	5 051	22 759	7 254	35 064
2026	21 339	13 725	35 064	4 690	22 883	7 491	35 064
2027	21 533	13 530	35 064	4 272	23 251	7 541	35 064
2028	21 576	13 488	35 064	4 530	23 122	7 412	35 064
2029	21 724	13 340	35 064	4 041	23 538	7 485	35 064
2030	21 886	13 178	35 064	3 757	23 677	7 630	35 064
2031	21 924	13 140	35 064	3 436	23 927	7 700	35 064
2032	21 958	13 106	35 064	2 989	24 416	7 658	35 064
2033	22 013	13 051	35 064	1 996	25 069	7 999	35 064
2034	22 073	12 991	35 064	2 410	24 686	7 967	35 064
2035	22 140	9 439	31 578	2 117	22 271	7 190	31 578
2036	22 140	6 881	29 021	1 659	20 627	6 735	29 021
2037	22 140	5 330	27 470	1 892	19 405	6 173	27 470
2038	22 140	4 149	26 289	1 608	18 616	6 065	26 289
2039	22 140	3 863	26 003	1 642	18 390	5 970	26 003
2040	22 140	4 260	26 400	2 067	18 391	5 942	26 400
2041	22 140	4 593	26 733	1 482	18 937	6 314	26 733
2042	22 140	5 028	27 168	2 100	19 118	5 951	27 168
2043	22 092	6 921	29 013	1 637	20 808	6 568	29 013
2044	22 048	7 676	29 724	2 046	20 980	6 698	29 724
2045	22 009	8 471	30 480	2 054	21 521	6 905	30 480
2046	21 974	9 198	31 172	2 067	22 034	7 070	31 172
2047	21 945	9 862	31 807	1 843	22 638	7 325	31 807
2048	21 974	10 610	32 584	1 717	23 263	7 604	32 584
2049	22 005	10 965	32 970	1 801	23 473	7 696	32 970
2050	22 040	10 936	32 976	2 018	23 355	7 603	32 976

Notes:
M3 cubic metres
IB inside bark

New Zealand Wood Availability Forecasts under Scenario 4 for radiata pine (Figures 4-10 and 4-11)

Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and total wood availability is modelled at a split non-declining yield with target rotation ages of 26, 28 and 30 years.

	Target Age = 26 Scenario 4a		Target Age = 28 Scenario 3		Target Age = 30 Scenario 4b	
Year Ending December	Recoverable Volume (000 m3 IB)	Average Age (years)	Recoverable Volume (000 m3 IB)	Average Age (years)	Recoverable Volume (000 m3 IB)	Average Age (years)
2015	29 601	27.3	29 020	28.9	28 707	30.4
2016	32 034	27.9	29 462	29.6	28 906	29.0
2017	34 275	28.1	29 840	29.3	28 899	28.8
2018	34 919	28.4	30 632	29.3	29 017	28.8
2019	35 401	28.5	31 566	29.4	29 401	28.8
2020	35 274	27.6	32 477	28.7	30 126	28.7
2021	35 274	28.2	32 930	28.1	31 066	27.9
2022	35 274	28.9	33 234	28.4	31 933	28.7
2023	35 274	29.3	34 376	28.7	32 427	29.2
2024	35 274	27.2	35 064	28.3	32 763	30.2
2025	35 274	27.8	35 064	28.9	34 135	30.0
2026	35 274	28.0	35 064	29.2	34 442	29.9
2027	35 274	27.9	35 064	28.9	34 780	30.0
2028	35 274	27.8	35 064	28.9	35 151	30.2
2029	35 274	28.4	35 064	29.3	35 294	30.3
2030	35 274	29.9	35 064	29.5	35 294	30.5
2031	35 274	31.5	35 064	30.1	35 294	30.8
2032	35 274	33.5	35 064	32.1	35 294	31.5
2033	31 893	30.9	35 064	33.1	35 294	31.9
2034	28 834	28.9	35 064	31.8	35 294	32.5
2035	26 447	28.2	31 578	30.7	34 905	32.1
2036	25 848	27.9	29 021	30.6	34 555	31.8
2037	25 854	27.7	27 470	29.8	30 773	30.7
2038	25 992	27.4	26 289	29.3	27 672	30.8
2039	26 236	28.2	26 003	30.0	26 026	30.4
2040	27 167	26.2	26 400	30.2	25 296	30.0
2041	29 092	27.4	26 733	28.5	24 863	30.3
2042	29 688	26.5	27 168	27.8	25 073	30.4
2043	30 411	25.9	29 013	28.6	25 712	30.3
2044	30 526	26.0	29 724	28.0	26 839	30.1
2045	30 780	26.2	30 480	28.6	28 905	29.9
2046	31 015	26.2	31 172	28.6	29 786	29.8
2047	31 574	26.2	31 807	28.8	30 155	29.9
2048	31 642	26.5	32 584	28.5	30 583	29.8
2049	31 642	26.7	32 970	28.4	31 130	29.8
2050	31 642	27.0	32 976	28.4	31 962	29.8

Notes:
m3 cubic metres IB inside bark

New Zealand Wood Availability Forecasts under Scenario 5 for Douglas-fir (Figure 4-15)

Assumes that large-scale owners harvest at stated intentions with yield regulated in subsequent years and a target rotation age of 40 years.

Year Ending December	Large-Scale Owners (000 m3 IB)	Small-Scale Owners (000 m3 IB)	All Owners (000 m3 IB)	Average Age (Years)
2015	993	34	1 028	42.3
2016	946	23	969	40.4
2017	972	22	994	39.2
2018	830	52	882	40.3
2019	850	81	931	40.0
2020	1 048	49	1 097	39.6
2021	1 007	25	1 032	39.8
2022	955	25	980	39.8
2023	1 139	50	1 189	41.3
2024	985	77	1 062	41.2
2025	912	88	999	40.8
2026	897	94	991	39.4
2027	875	106	981	40.6
2028	835	106	941	39.0
2029	923	329	1 252	40.8
2030	931	283	1 214	39.3
2031	929	259	1 188	39.3
2032	956	259	1 214	38.6
2033	923	261	1 184	38.8
2034	997	574	1 571	40.2
2035	1 050	515	1 565	38.8
2036	1 020	517	1 538	39.7
2037	1 020	521	1 541	39.6
2038	1 020	514	1 534	39.5
2039	1 072	699	1 771	39.9
2040	1 031	691	1 722	40.0
2041	1 072	700	1 772	40.5
2042	1 066	730	1 796	42.0
2043	1 027	730	1 757	43.5
2044	1 281	562	1 842	43.0
2045	1 268	554	1 823	44.6
2046	1 299	550	1 849	46.0
2047	1 249	618	1 867	47.2
2048	1 249	548	1 797	48.0
2049	1 021	386	1 407	47.9
2050	1 021	400	1 420	47.2

Notes:
m3 cubic metres
IB inside bark

New Zealand Wood Availability Forecasts under Scenario 6A for Cypresses (Figure 4-21)

Assumes that large-scale owners harvest at stated intentions then a target rotation age of 35 years.

Year	Large-Scale Owners (m3)	Small- Scale Owners (m3)	Combined (m3)
2 015	17 962	3 138	21 100
2 016	23 231	6 113	29 344
2 017	26 429	1 961	28 390
2 018	30 350	1 177	31 526
2 019	29 267	5 099	34 366
2 020	27 116	10 983	38 099
2 021	31 884	3 922	35 807
2 022	0	6 958	6 958
2 023	0	11 198	11 198
2 024	103 673	6 276	109 949
2 025	103 673	2 746	106 419
2 026	103 673	27 066	130 739
2 027	103 673	35 039	138 712
2 028	103 673	34 237	137 911
2 029	103 673	49 145	152 818
2 030	103 673	46 571	150 245
2 031	103 673	30 538	134 211
2 032	103 673	22 163	125 837
2 033	103 673	42 854	146 527
2 034	103 673	29 705	133 378
2 035	103 673	18 333	122 006
2 036	103 673	36 463	140 137
2 037	103 673	9 806	113 480
2 038	103 673	24 319	127 993
2 039	103 673	69 937	173 611
2 040	103 673	15 298	118 971
2 041	103 673	4 315	107 988
2 042	103 673	36 802	140 475
2 043	103 673	21 649	125 322
2 044	103 673	10 639	114 313
2 045	103 673	29 494	133 167
2 046	103 673	13 336	117 010
2 047	103 673	3 726	107 400
2 048	103 673	4 844	108 518
2 049	103 673	0	103 673
2 050	103 673	0	103 673

New Zealand Wood Availability Forecasts under Scenario 6B for Other Softwoods (Figure 4-23)

Assumes that large-scale owners harvest at stated intentions then a target rotation age of 35 years.

Year	Large-Scale Owners (m3)	Small- Scale Owners (m3)	Combined (m3)
2 015	146 961	45 552	192 512
2 016	170 590	198 368	368 957
2 017	108 038	116 934	224 972
2 018	130 756	14 759	145 515
2 019	120 271	70 526	190 797
2 020	142 220	76 537	218 758
2 021	119 894	37 188	157 082
2 022	46 424	47 644	94 067
2 023	14 608	28 546	43 154
2 024	116 518	42 974	159 493
2 025	116 518	76 656	193 174
2 026	116 518	55 055	171 573
2 027	116 518	280 376	396 894
2 028	116 518	310 928	427 447
2 029	116 518	494 398	610 917
2 030	116 518	239 154	355 673
2 031	116 518	305 841	422 359
2 032	116 518	127 200	243 719
2 033	116 518	278 058	394 577
2 034	116 518	341 471	457 990
2 035	116 518	147 960	264 478
2 036	116 518	163 612	280 131
2 037	116 518	142 060	258 579
2 038	116 518	149 968	266 487
2 039	116 518	92 395	208 914
2 040	116 518	48 669	165 187
2 041	116 518	26 308	142 826
2 042	116 518	44 100	160 618
2 043	116 518	17 256	133 775
2 044	116 518	14 524	131 042
2 045	116 518	36 698	153 217
2 046	116 518	27 457	143 976
2 047	116 518	35 773	152 291
2 048	116 518	12 284	128 803
2 049	116 518	0	116 518
2 050	116 518	0	116 518

New Zealand Wood Availability Forecasts under Scenario 6C for Eucalypts (Figure 4-25)

Assumes that large-scale owners harvest at stated intentions then a non-declining yield and a target rotation age for small-scale owners of 20 years.

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Year	Large-Scale Owners (m3)	Small-Scale Owners (m3)	Combined (m3)
2 015	327 000	148 338	475 338
2 016	316 000	246 567	562 567
2 017	341 000	100 699	441 699
2 018	336 000	27 625	363 625
2 019	336 000	47 727	383 727
2 020	297 084	40 101	337 185
2 021	308 000	46 384	354 384
2 022	349 000	68 932	417 932
2 023	333 109	6 458	339 568
2 024	338 242	12 095	350 337
2 025	338 242	0	338 242
2 026	338 242	1 779	340 021
2 027	338 242	2 372	340 614
2 028	338 242	8 695	346 937
2 029	338 242	54 855	393 097
2 030	338 242	83 914	422 156
2 031	338 242	18 384	356 626
2 032	338 242	3 944	342 186
2 033	338 242	4 098	342 340
2 034	338 242	1 388	339 630
2 035	338 242	0	338 242
2 036	338 242	101 970	440 212
2 037	338 242	179 226	517 468
2 038	338 242	75 872	414 114
2 039	338 242	116 808	455 050
2 040	338 242	71 928	410 170
2 041	338 242	58 396	396 638
2 042	338 242	10 930	349 171
2 043	338 242	69 089	407 331
2 044	338 242	41 621	379 863
2 045	338 242	32 483	370 725
2 046	338 242	15 049	353 290
2 047	338 242	79 499	417 741
2 048	338 242	38 175	376 417
2 049	338 242	4 602	342 844
2 050	338 242	56 209	394 451

New Zealand Wood Availability Forecasts under Scenario 6D for Other Hardwoods (Figure 4-28)

Assumes that large-scale owners harvest at stated intentions then a non-declining yield and small-scale owners harvest at a target rotation age of 25 years.

Year	Large-Scale Owners (m3)	Small-Scale Owners (m3)	Combined (m3)
2 015	10 402	103 553	113 955
2 016	94 968	603 688	698 656
2 017	44 240	212 615	256 856
2 018	21 218	211 620	232 838
2 019	23 528	283 410	306 938
2 020	20 813	184 384	205 197
2 021	34 466	233 803	268 269
2 022	26 609	267 626	294 235
2 023	21 873	186 576	208 450
2 024	64 791	190 295	255 086
2 025	64 791	147 312	212 103
2 026	64 791	164 578	229 369
2 027	64 791	122 390	187 181
2 028	64 791	96 382	161 173
2 029	64 791	90 881	155 672
2 030	64 791	65 789	130 580
2 031	64 791	38 458	103 249
2 032	64 791	11 710	76 501
2 033	64 791	4 294	69 085
2 034	64 791	2 342	67 133
2 035	64 791	4 684	69 475
2 036	64 791	17 174	81 965
2 037	64 791	4 821	69 612
2 038	64 791	2 225	67 016
2 039	64 791	0	64 791
2 040	64 791	0	64 791
2 041	64 791	74 905	139 696
2 042	64 791	510 035	574 826
2 043	64 791	206 237	271 028
2 044	64 791	205 272	270 063
2 045	64 791	274 932	339 723
2 046	64 791	178 853	243 644
2 047	64 791	226 812	291 603
2 048	64 791	259 597	324 388
2 049	64 791	180 979	245 770
2 050	64 791	184 586	249 377

New Zealand Wood Availability Forecasts under Scenario 7A for Cypresses (Figure A-1)

Assumes that large-scale owners harvest at stated intentions then a non-declining yield and total non-declining yield with a target rotation age of 35 years.

Year	Large-Scale Owners (m3)	Small-Scale Owners (m3)	Combined (m3)
2 015	18 143	7 719	25 863
2 016	23 312	2 582	25 895
2 017	26 429	2 055	28 484
2 018	30 156	1 177	31 333
2 019	29 367	5 099	34 466
2 020	26 930	10 983	37 913
2 021	31 726	8 206	39 931
2 022	0	39 931	39 931
2 023	0	39 931	39 931
2 024	103 674	18 367	122 040
2 025	103 674	18 367	122 040
2 026	103 674	18 367	122 040
2 027	103 674	18 367	122 040
2 028	103 674	18 367	122 040
2 029	103 674	18 367	122 040
2 030	103 674	18 367	122 040
2 031	103 674	18 367	122 040
2 032	103 674	18 367	122 040
2 033	103 674	18 367	122 040
2 034	103 674	18 367	122 040
2 035	103 674	18 367	122 040
2 036	103 674	18 367	122 040
2 037	103 674	18 367	122 040
2 038	103 674	18 367	122 040
2 039	103 674	18 367	122 040
2 040	103 674	18 367	122 040
2 041	103 674	18 367	122 040
2 042	103 674	18 367	122 040
2 043	103 674	18 367	122 040
2 044	103 674	18 367	122 040
2 045	103 674	18 367	122 040
2 046	103 674	18 367	122 040
2 047	103 674	18 367	122 040
2 048	103 674	18 367	122 040
2 049	103 674	18 367	122 040
2 050	103 674	18 367	122 040

New Zealand Wood Availability Forecasts under Scenario 7B for Other Softwoods (Figure A-3)

Assumes that large-scale owners harvest at stated intentions then a non-declining yield and a total non-declining yield.

Year	Large-Scale Owners (m3)	Small-Scale Owners (m3)	Combined (m3)
2 015	146 780	59 426	206 206
2 016	170 508	35 956	206 464
2 017	108 038	119 073	227 110
2 018	130 950	100 510	231 460
2 019	120 171	111 289	231 460
2 020	142 407	89 053	231 460
2 021	120 052	111 408	231 460
2 022	46 424	185 036	231 460
2 023	14 608	216 852	231 460
2 024	116 520	112 038	228 558
2 025	116 520	112 038	228 558
2 026	116 520	112 038	228 558
2 027	116 520	112 038	228 558
2 028	116 520	112 038	228 557
2 029	116 520	112 038	228 558
2 030	116 520	112 038	228 557
2 031	116 520	112 038	228 558
2 032	116 520	112 038	228 558
2 033	116 520	112 038	228 558
2 034	116 520	112 038	228 558
2 035	116 520	112 038	228 558
2 036	116 520	112 038	228 558
2 037	116 520	112 038	228 557
2 038	116 520	112 038	228 557
2 039	116 520	112 038	228 557
2 040	116 520	112 038	228 558
2 041	116 520	112 038	228 558
2 042	116 520	112 038	228 558
2 043	116 520	112 038	228 558
2 044	116 520	112 038	228 557
2 045	116 520	112 038	228 558
2 046	116 520	112 038	228 558
2 047	116 520	112 038	228 557
2 048	116 520	112 038	228 558
2 049	116 520	112 038	228 558
2 050	116 520	112 038	228 558

New Zealand Wood Availability Forecasts under Scenario 7C for Eucalypts (Figure A-5)

Assumes that large-scale owners harvest at stated intentions then a non-declining yield and a total non-declining yield.

Year	Large-Scale Owners (m3)	Small-Scale Owners (m3)	Combined (m3)
2 015	327 000	58 927	385 927
2 016	316 000	70 409	386 409
2 017	341 000	45 409	386 409
2 018	336 000	50 409	386 409
2 019	336 000	50 409	386 409
2 020	297 084	89 326	386 409
2 021	308 000	78 409	386 409
2 022	349 000	37 409	386 409
2 023	333 109	53 300	386 409
2 024	340 304	46 105	386 409
2 025	340 304	46 105	386 409
2 026	340 304	46 105	386 409
2 027	340 304	46 105	386 409
2 028	340 304	46 105	386 409
2 029	340 304	46 105	386 409
2 030	340 304	46 105	386 409
2 031	340 304	46 105	386 409
2 032	340 304	46 105	386 409
2 033	340 304	46 105	386 409
2 034	340 304	46 105	386 409
2 035	340 304	46 105	386 409
2 036	340 304	46 105	386 409
2 037	340 304	46 105	386 409
2 038	340 304	46 105	386 409
2 039	340 304	46 105	386 409
2 040	340 304	46 105	386 409
2 041	340 304	46 105	386 409
2 042	340 304	46 105	386 409
2 043	340 304	46 105	386 409
2 044	340 304	46 105	386 409
2 045	340 304	46 105	386 409
2 046	340 304	46 105	386 409
2 047	340 304	46 105	386 409
2 048	340 304	46 105	386 409
2 049	340 304	46 105	386 409
2 050	340 304	46 105	386 409

New Zealand Wood Availability Forecasts under Scenario 7D for Other Hardwoods (Figure A-7)

Assumes that large-scale owners harvest at stated intentions then a non-declining yield and a total non-declining yield.

Year	Large-Scale Owners (m3)	Small-Scale Owners (m3)	Combined (m3)
2 015	10 402	174 508	184 910
2 016	94 968	90 174	185 142
2 017	44 240	140 901	185 142
2 018	21 218	163 923	185 142
2 019	23 528	161 613	185 142
2 020	20 813	164 329	185 142
2 021	34 466	150 676	185 142
2 022	26 609	158 533	185 142
2 023	21 873	163 268	185 142
2 024	65 210	119 931	185 142
2 025	65 210	119 931	185 142
2 026	65 210	119 931	185 142
2 027	65 210	119 931	185 142
2 028	65 210	119 931	185 142
2 029	65 210	119 931	185 142
2 030	65 210	119 931	185 142
2 031	65 210	119 931	185 142
2 032	65 210	119 931	185 142
2 033	65 210	119 931	185 142
2 034	65 210	119 931	185 142
2 035	65 210	119 931	185 142
2 036	65 210	119 931	185 142
2 037	65 210	119 931	185 142
2 038	65 210	119 931	185 142
2 039	65 210	119 931	185 142
2 040	65 210	119 931	185 142
2 041	65 210	119 931	185 142
2 042	65 210	119 931	185 142
2 043	65 210	119 931	185 142
2 044	65 210	119 931	185 142
2 045	65 210	119 931	185 142
2 046	65 210	119 931	185 142
2 047	65 210	119 931	185 142
2 048	65 210	119 931	185 142
2 049	65 210	119 931	185 142
2 050	65 210	119 931	185 142

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